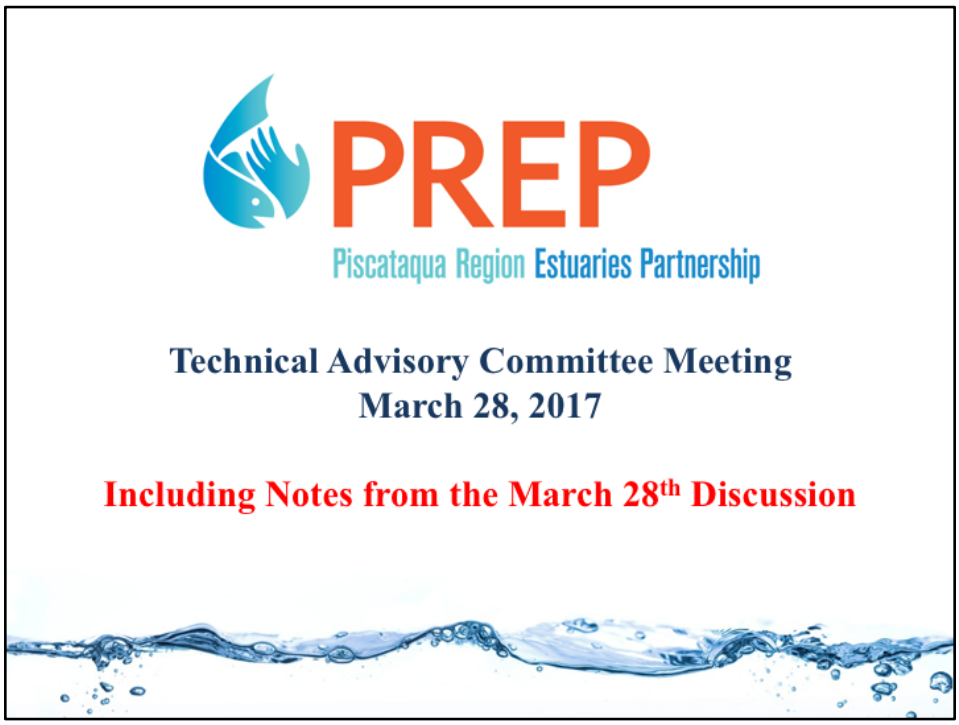


List of Attendees

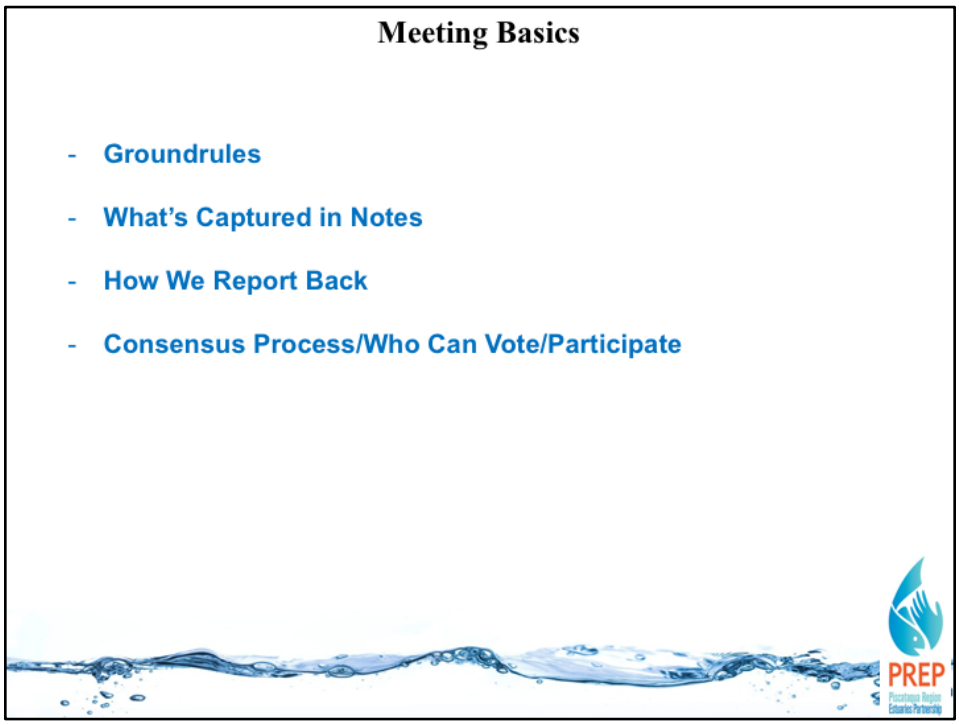
Paul Stacey, Toby Stover, Dan Arsenault, John Storer, Jeff Barnum, Matt Wood, Ted Diers, Steve Couture, Dean Peschel, Fred Short, Rob Roseen, Ken Edwardson, Terry Desmarais, John Hall, Tao H., Sally Soule, Wil Wollheim, Robert Lucic, Connie White, Tom Gregory, Erick Sawtelle, Joel Destasio, Jean Brochi, Michelle Shattuck and Ellie Baker.

And PREP Staff: Rachel Rouillard, Kalle Matso, Abigail Lyon, and Simone Barley-Greenfield

About These Notes

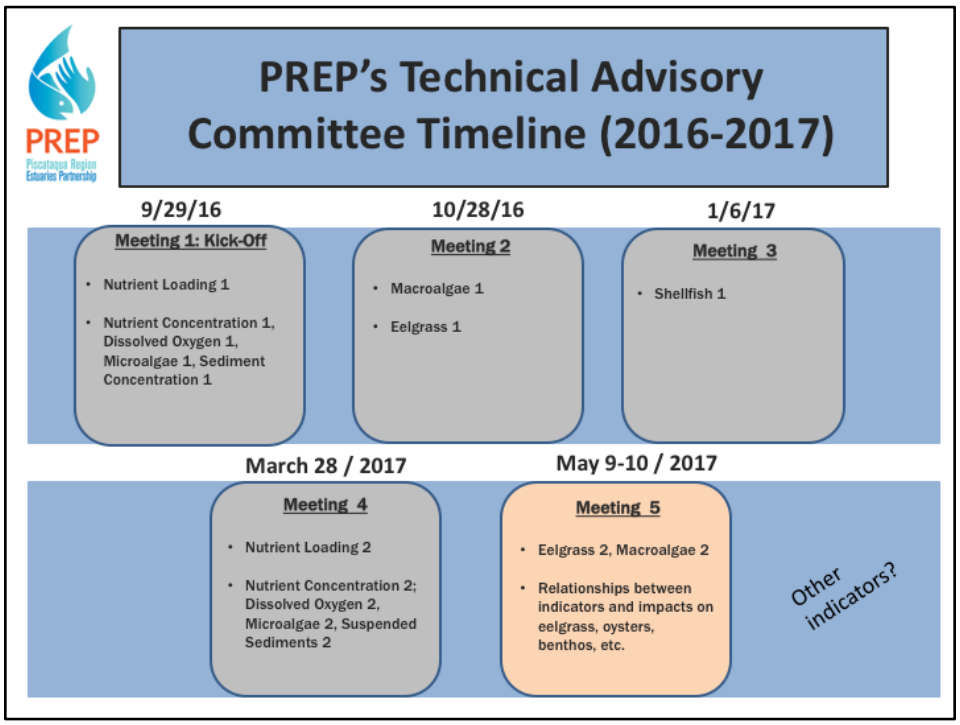
Readers will feel at times as though these notes are verbatim from the meeting. They should not be considered verbatim. Rather, we attempted to make the notes more conversational for readability. Please do not quote these notes as though it is a verbatim transcript.

Sometimes, when PREP staff are not sure about name of the speaker, we will list the person more generically as "Committee Member."



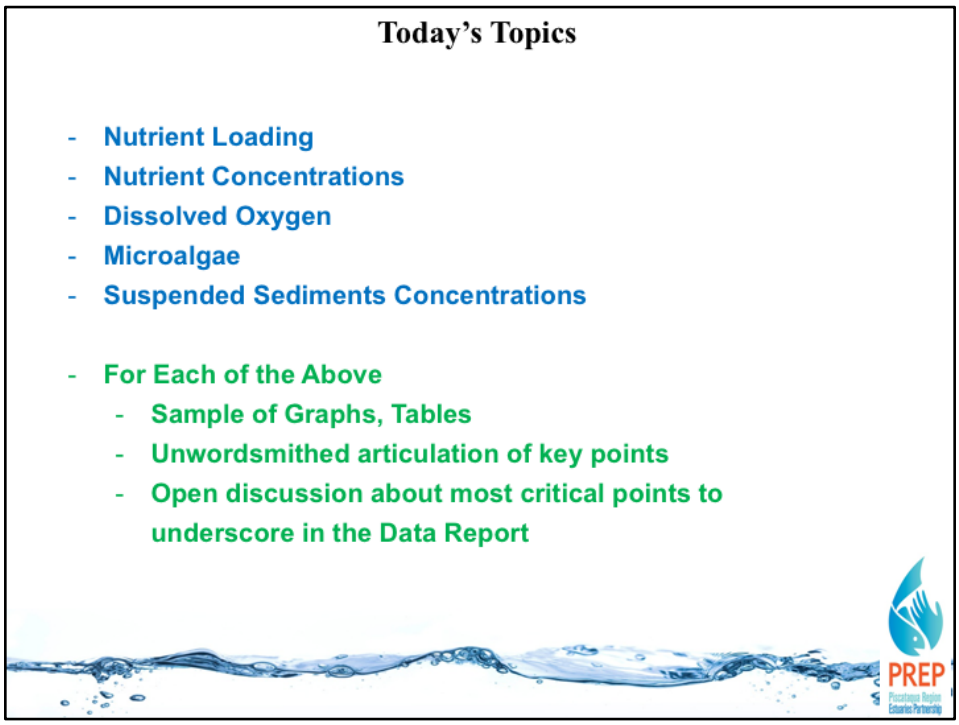
Kalle:

Just a reminder that the TAC is a completely open process. Everyone is invited and everyone has equal standing. I'm not anticipating any voting today, but if we do vote I will explain the consensus decision making process.



Kalle: You can see where we are today. Then on, May 9 and May 10, we are going to focus in on the 800 pound gorilla which is why is eelgrass struggling so much. We may try to cover more, but the eelgrass subject is an important issue and it needs its due. I hope you are able to attend. We will be asking for the Municipal Coalition, DES, Fred Short, etc. to give presentations. External advisors Jud Kenworthy and Ken Moore, both seagrass experts, will be attending as well.

These TAC meeting have been dedicated to covering the most controversial indicators. For other important indicators, such as migratory fish returns and beach closures, drafts will be sent out electronically so that people can comment on those.



Kalle:

Today's topics: nutrient loading, nutrient concentration, dissolved oxygen, microalgae, suspended sediment concentrations

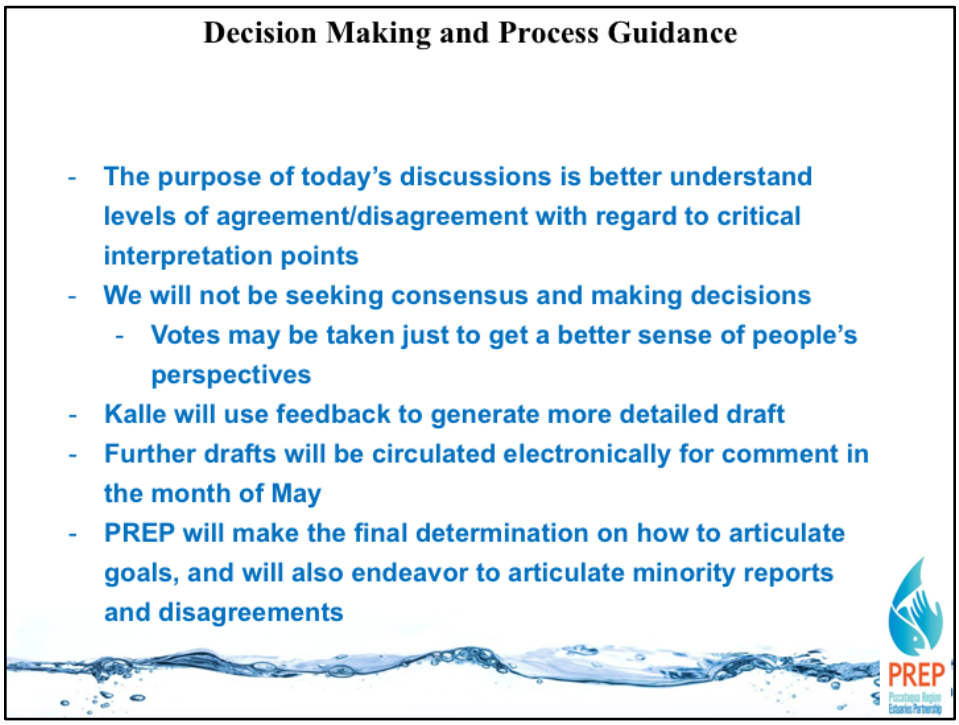
For each we will show a sample of the graphs, unwordsmithed articulation of key points and open discussion about the most critical points to underscore the data report.

You will get to see the sausage made. It's not clean, we don't go from 0 to an answer, but rather we need to talk about these things, and we're trying very hard to do this in an open manner.

Jeannie: Can you elaborate re: sausage making? I think some of us thought the sausage was already made from the previous reports.

Kalle: Anyone who has to write these reports has to make lots of little decisions that really impact how the report comes across, and the message received by the audience. Jeannie is right that the basic set up is still the same, but I'm faced with

different choices in how to talk about the issues, and that's where I'm looking for input. For example, when we look at some of the levels of phytoplankton, how should we put that in context? One way is to talk about the levels of phytoplankton in Chesapeake Bay that have proved too high for eelgrass. That's helpful, but it may not necessarily apply to the Great Bay Estuary. Making those decisions—as well as some technical choices about displaying graphs and statistical results—that's what I mean by making the sausage.



Kalle:

Decision making and process guidance. We will not be talking about the answer; we won't be seeking some consensus. Drafts will be circulated in May for comment. We are a group of people who all see things differently. At some point PREP is going to decide what PREP thinks is the best way to move forward. If you disagree you will just need to make that known.

Paul Stacey: When you say PREP, do you mean staff decisions or do we consider ourselves PREP?

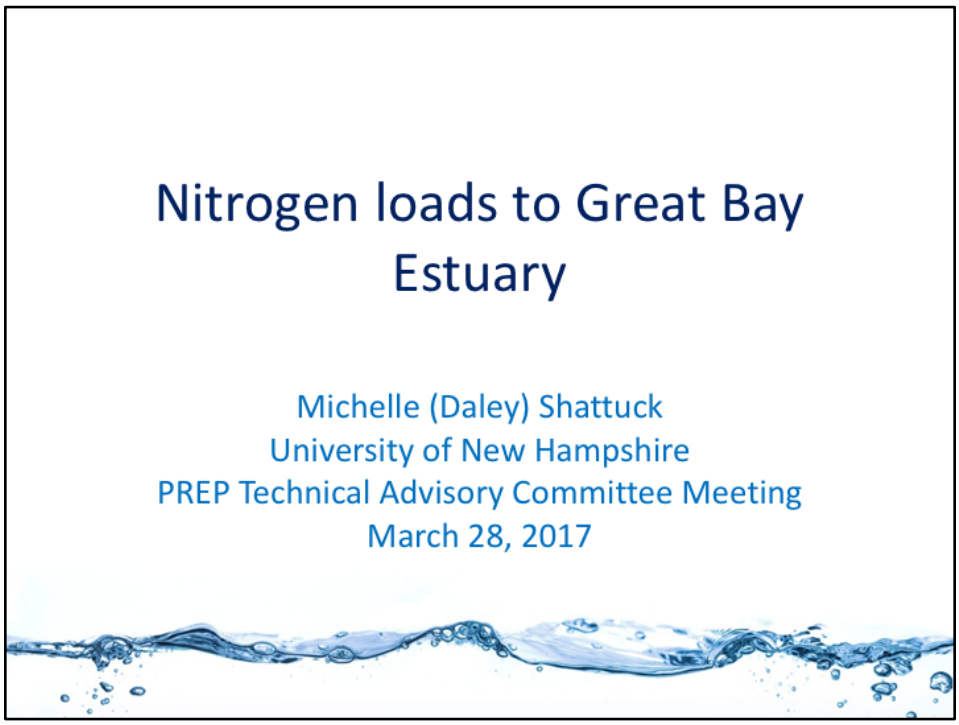
Kalle: No I mean me, Rachel, and Abby.

Paul: If it's consensus how do you plan to attempt that?

Kalle: When there's a very concrete fork in the road, I will try to seek input and consensus. But there are so many small decisions to be made…it's impossible to go through a consensus process for all these little decisions.

Paul: Will there be a review process once the final report is done?

Kalle: The data report will be completed in the fall and we will have a review process. The SOOE document is being produced right now, because of the print production calendar. Key messages developed as early as possible and I'm hoping to get wide input on that as well.



Kalle: Now, I'll turn it over to Michelle Shattuck who has been helping us with understanding changes in nutrient loading.

PREP 2012 Environmental Data Report

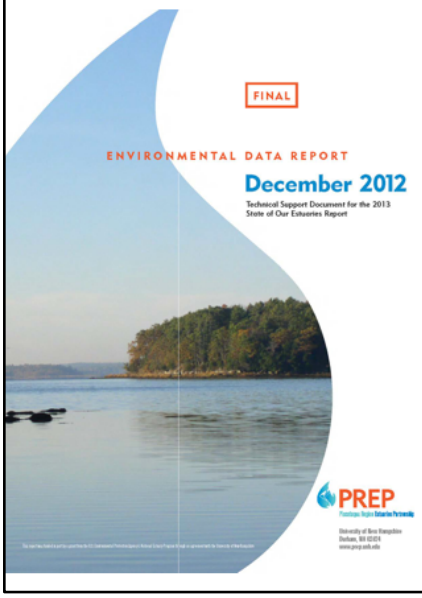


Table of Contents

Michelle: So I'll be focusing on the nitrogen loads, which is one of the indicators highlighted in the Data Report and the State of Our Estuaries Report.

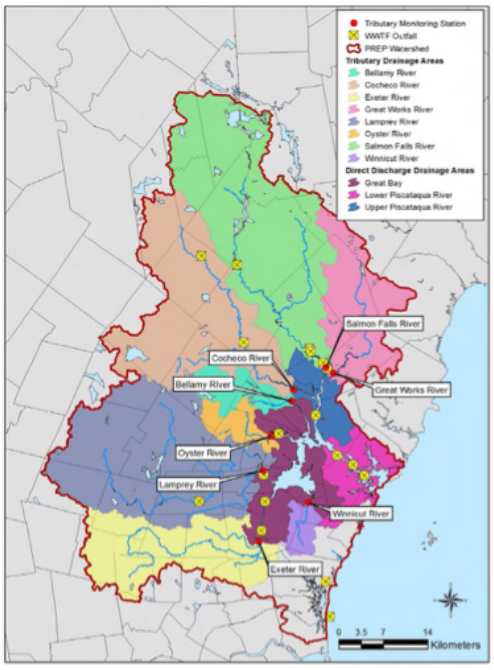
Nitrogen loads to Great Bay Estuary (GBE)

<u>Point sources</u>

- Municipal Wastewater Treatment Facilities (WWTFs)

<u>Non-point sources (NPS)</u>

- Watershed tributaries
- Groundwater Discharge
- Atmospheric Deposition



Total Nitrogen (TN) and Dissolved inorganic Nitrogen (DIN) Discharge from WWTFs

Average TN or DIN concentration (mass/volume) X Average Monthly Effluent flow (volume/time) = TN or DIN load (mass/time)

2012-2016

Annual

Growing Season vs. Non-Growing Season

(April-Oct vs. Nov-March)

WWTF N delivery factors

18 WWTFs

- 6 discharge to tidal rivers
- 8 discharge to freshwater rivers
- 4 discharge to the lower Piscataqua River

Delivery Factor Source: PREP 2012 SOOE Data Report

WWTFs included in preliminary data

- These WWTF represent 92% of the delivered TN and DIN load

WWTF	Delivery Factor (%)
Dover	100.00%
Durham	100.00%
Exeter	100.00%
Newfields	100.00%
Newmarket	100.00%
South Berwick	100.00%
Berwick	94.55%
Epping	58.20%
Farmington	41.93%
Kittery	14.20%
Milton	65.70%
Newington	26.34%
North Berwick	51.56%
Pease ITP	26.34%
Portsmouth	12.50%
Rochester	75.56%
Rollinsford	98.96%
Somersworth	94.94%

Michelle: All the data isn't in yet, but I've been trying very hard to incorporate the 2016 data as well, which we only got a few weeks ago, so it's been a really big push to get this done in time.

Yellow highlighted WWTF have been submitting N concentrations to EPA. Can get loads with monthly flows from those numbers. These WWTF represent 92% of the delivered TN and DIN load.

WWTF Data Sources

PREP SOE 2012

- Flow data from monthly operating reports
- N data from NHEP 2008, WWTFs or estimated

PREP SOE 2017

- Flow data from monthly operating reports
- TN concentration data submitted to EPA
  - Exeter, Newmarket, Dover, Durham, Newington, Rochester, Portsmouth and Somersworth
  - TN and some other forms (TKN, NH_3, NO_2/NO_3)

➢ Scour MORs and DMRs for other WWTFs

➢ Estimate N concentrations for other WWWFs and time periods with no N data

Michelle: This slide just shows that we've tried to imporove the level of data for these assessments since the last data report.

WWTF TN and DIN delivered loads

		2009-2011		2012-2016					
WWTF	**Delivery Factor**	Delivered TN Load (tons/yr)	Delivered DIN Load (tons/yr)	Months with TN data (max 60)	Months with DIN data (max 60)	Delivered TN load (tons/yr)	Delivered DIN load (tons/yr)	% Change in TN Load	% Change in DIN Load
Dover	100.0%	94.02	64.46	52	52	68.7	57.8	-27%	-10%
Durham	100.0%	14.88	12.95	53	53	17.5	13.7	18%	6%
Exeter	100.0%	41.80	30.15	45	0	55.5	46.9	33%	56%
Newington	26.3%	0.96	0.75	52	52	0.8	0.7	-22%	-9%
Newmarket	100.0%	27.99	18.18	45	0	31.1	26.3	11%	45%
Portsmouth	12.5%	29.49	20.60	54	54	24.4	17.6	-17%	-14%
Rochester	75.6%	140.01	127.10	43	41	57.7	55.9	-59%	-56%
Somersworth	94.9%	11.31	9.92	23	0	14.1	11.9	24%	20%
	Total	**360.5**	**284.1**			**269.7**	**230.8**	**-25%**	**-19%**
	%DIN		78.8%				85.6%		

Estimated based on mean % DIN

Michelle: Since some of the treatment plants don't report on some of our needed values, I've estimated those numbers based on the other treatment plants. Delivered load from 2012-2016 from 8 plants 270 tons/year of TN which is down about 25% from previous 2009-2011 period. For DIN 231 ton/year which dropped about 20%. Notice especially the big reductions in Rochester (almost 60%!) as well as Dover and Newington.

Kalle: Can you also speak to precipitation and how it might affect this if at all.

Michelle: Haven't looked at average annual precip data, but we do see the drought in 2016 so we tend to have higher flows when we have higher precip. So with a dry year (2016) it might be pulling things down slightly.

Wil Wollheim: What about population served?

Michelle: Haven't looked at that yet but we will.

Dean Peschel: Comment…the previous baseline was based on 3 year average, and current is a 5 year period. Looking at % change…which is what people are interested in…using 5 year average you are missing the reductions in Dover and Rochester. I would actually say the reductions are more impressive that what this data is showing.

Michelle: We will present the data both ways, annual basis and overall average. I do agree that we should be presenting annual changes, too. Especially when we get that

data.

Kalle: We won't let that get lost. We want to share that story.

Paul Stacey: I would suggest that you show discharge volume data with these numbers (as in MGD for the different plants). That way you can separate out the more durable trends from effects caused by wet versus dry years.

Dan Arsenault: Although some upgrades haven't taken place yet, it might be helpful to the broader community to put an asterisk indicating that Newmarket is going online July 2017; portsmouth and exeter in in 2019, and Newington as well.

Matt Wood: You can also identify what year these plants have upgraded. So, when did Dover upgrade? How about Rochester? etc.

Dave Cedarholm: Population changes make this story more complicated. In Durham, there was development that added 1000+ users…most of those residents were from surrounding towns that created vacancies in those towns. So, we need to be careful in in comparing community to community.

John Hall: You may want to make it clear that while Dover and Exeter both deliver 100% to the estuary, those two loads have a different impact on the system. The impact of Exeter is going to be much higher on the Great Bay, while Dover has less impact on Great Bay and more on the Piscataqua River.

Fred Short: When you say that 12% of the Portsmouth load is delivered…is that to the Great Bay Estuary?

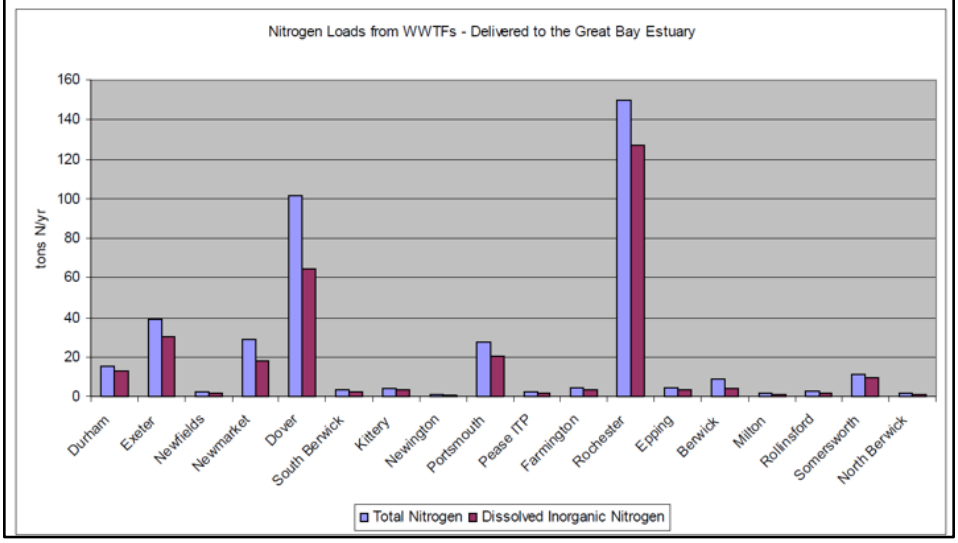
Michelle: Yes.

Dan A: 7% of the 12.5% from Portsmouth goes up into Little Bay, the rest of the 12% goes up into the Upper Piscataqua. We're only talking about the 12.5% because the rest goes up and/or down the coast.

Update when WWTF data is complete:

WWTF TN and DIN delivered loads

Figure NUT1-2: Estimated total nitrogen and dissolved inorganic nitrogen loads from wastewater treatment facilities in 2008



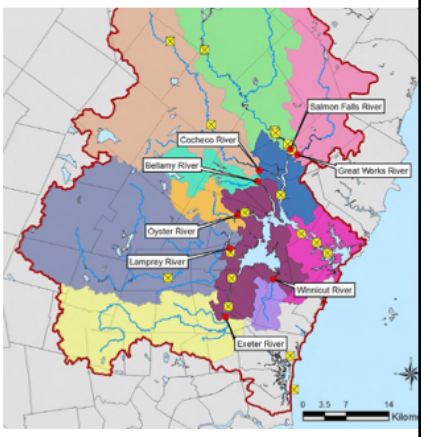
Michelle: This slide is from the last report and we could do something like this again, and/or break it out by year.

TN and DIN loads from major watersheds

- 8 head of tide sampling stations sampled monthly March – December
- USGS LOADEST model (Runkel et al., 2004)

  Inputs:
  - Monthly TN and DIN concentrations
  - Estimated daily average stream flow (4 USGS stations)

  Outputs:
  - Average load for study period
  - Monthly load
  - Growing season vs non-growing season (April-Oct, Nov-March)



Loadest TN and DIN models 2012-2016

	Loadest TN (tons/yr) Model			Loadest DIN (tons/yr) Model		
Tributary	**R^2 (%)**	**PPCC**	**Model**	**R^2 (%)**	**PPCC**	**Model**
Lamprey	97.8	0.9934	3	91.4	0.9927	6
Bellamy	96.1	0.9921	1	86.4	0.9867	4
Cocheco	90.1	0.9839	9	83.1	0.9881	7
Exeter	99.0	0.9827	2	93.1	0.9822	6
Great Works	96.0	0.9892	2	89.2	0.9670	6
Oyster	98.2	0.9850	9	94.7	0.9667	9
Salmon Falls	97.2	0.9584	1	94.0	0.9874	8
Winnicut	98.8	0.9858	5	94.5	0.9936	9

- R^2 is a measure of the quality of the loading regression model (0=worst, 100%=best)
- PPCC is a measure of the normality of the residuals (0=worst, 1=best)
- The model number refers to the specific model chosen. The models are defined in the LOADEST users manual (Runkel et al, 2004).

Michelle: The purpose of this slide is to show you that the LOADEST models are quite strong.An R2 of 97.8% for Lamprey, means the model can explain 97.8% of the variability. The PPCC is a measure of the normality of the residuals, which just means, for each data point, the difference between the actual and what was predicted by the model. Ideally, you want those numbers to be as close to 1 as possible.

Loadest Tidal Tributary
Total TN and DIN load

	2009-2011				2012-2016						
Site	TN Load (tons/yr)	Standard Error TN (tons/yr)	DIN Load (tons/yr)	Standard Error (tons/yr)	TN Load (tons/yr)	Standard Error TN (tons/yr)	DIN Load (tons/yr)	Standard Error DIN (tons/yr)	TN Load (tons/yr/mi^2)	DIN Load (tons/yr/mi^2)	Upstream WWTF?
Bellamy	23.54	1.58	5.74	0.51	16.10	0.78	4.79	0.45	0.59	0.18	No
Cocheco	269.01	18.07	179.76	12.23	194.67	15.38	121.97	12.94	1.11	0.70	Yes
Exeter	89.31	6.12	25.82	4.15	55.52	1.82	18.01	2.43	0.52	0.17	No
Great Works	59.86	3.67	18.98	1.89	53.64	3.00	17.68	2.13	0.62	0.20	Yes
Lamprey	176.30	12.78	57.45	7.68	112.51	4.26	39.39	4.52	0.53	0.19	Yes
Oyster	20.88	1.50	7.73	1.14	14.05	0.74	6.84	0.91	0.71	0.34	No
Salmon Falls	172.28	11.50	57.88	4.70	124.91	4.62	50.05	3.34	0.53	0.21	Yes
Winnicut	19.14	1.43	5.50	0.86	11.13	0.46	5.00	0.62	0.79	0.35	No
Total	**830.3**		**358.9**		**582.5**		**263.7**		**5.4**	**2.3**	

Michelle: Using LOADEST, we do see a decline from the last monitoring period. Again though, we do have the drought period which could be what's driving some of these results. Later on when we get more data it would be good to look at the EGRET model (but for that you need 20 years of data and 200 data points), which does a better job at looking at trends overtime and normalizing flow.

The Cocheco and Lamprey and SF have the highest TN loads, but when you area weight these it's actually the Cocheco, Oyster and Winnicut that have the highest weighted loads. Fred Short: The Cocheco has the Rochester plant upstream. Is that removed from this calculation?

Michelle: No, but it will be. Need data from the upstream plants first before I back it out.

Fred: Will you be presenting the yearly data?

Michelle: Yes but using LOADEST not EGRET.

Paul Stacey: Same as Fred…just encouraging you to remove the WWTF load and use it as an enrichment factor for each watershed to prioritize stormwater contributions.

Michelle: We absolutely will back out the point source loads, we just don't have that data just yet.

Erick Sawtelle: Were all of these samples taken at the head of tide?

Michelle: Yes

Dan: Exeter River, not sure when it happened…but what about the Great Dam removal? Does that have an affect?

Michelle: Didn't look at the exact timing…but it's still a freshwater site and not getting any brackish water. Site is still 100% freshwater.

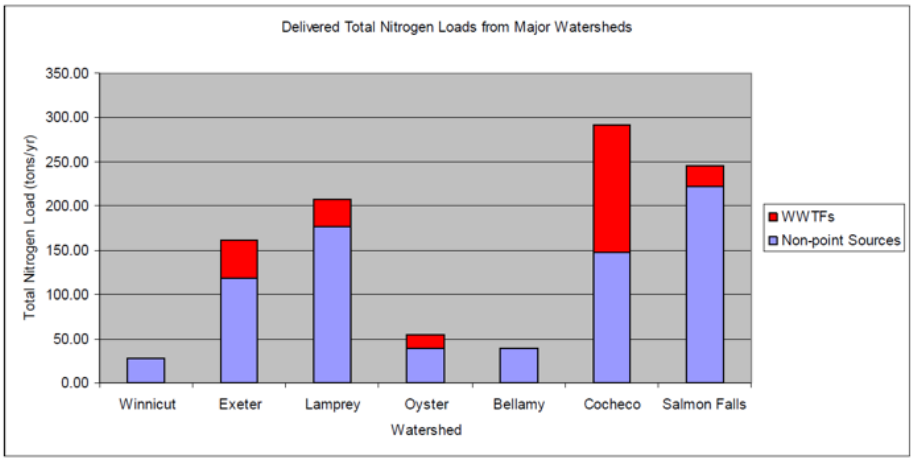
John Hall: Exeter is a case where the head of tide would have been above the dam and WWTF was below it. Are you doing any areal loading estimates for the addition of loaidng from the watersheds below?

Michelle: Yes we will get to that.

Update when all WWTF data is complete:

Total Nitrogen delivered from Major Watersheds – WWTFs and NPS

Figure NUT1-3: Estimated nitrogen loads from major tributaries in 2006-2008
(A) Total Nitrogen

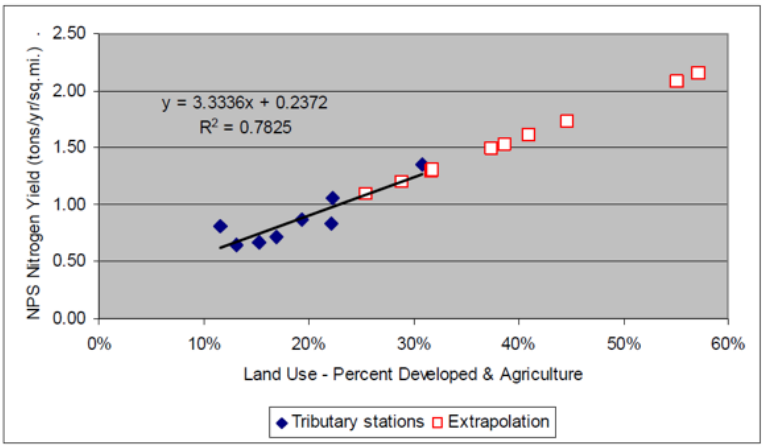


Measured load at head of tide stations – delivered load from upstream WWTF. Total Nitrogen delivered from major watersheds WWTF and NPS

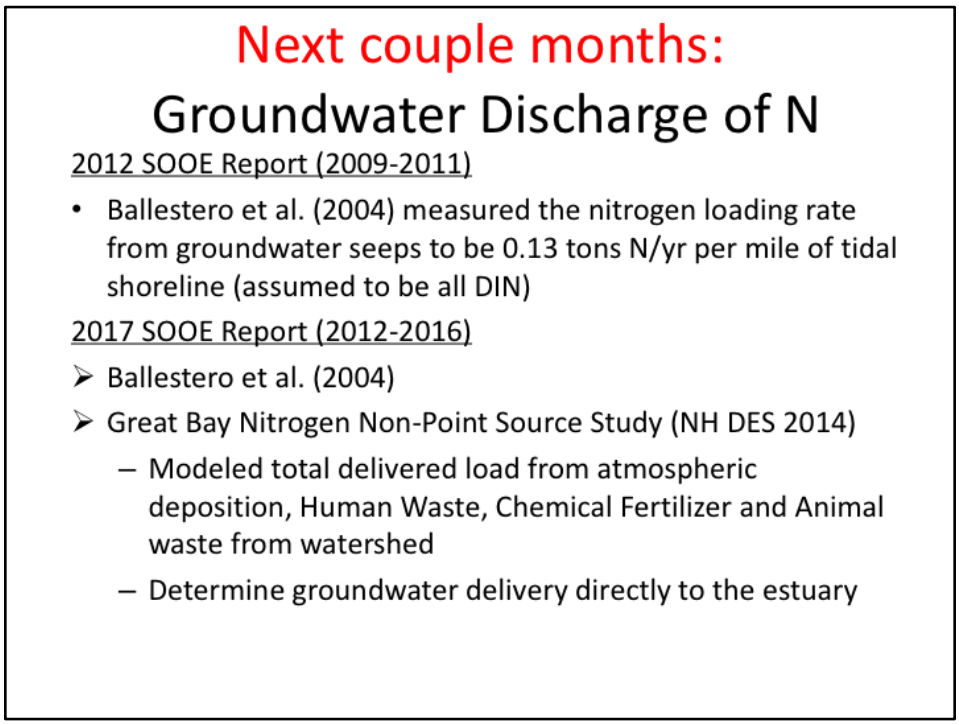
Next couple months: trying to estimate NPS delivered from the areas from downstream of the WWTF upstream

Next couple months:
Determine NPS inputs downstream of dams

Figure NUT1-4: Relationship between non-point source nitrogen yields and land use in major watersheds and extrapolations to small watersheds downstream of dams 2009-2011 (A) Total Nitrogen (update with 2012-2016 loads and current land use)



Look at relationship from NPS load (backing out WWTF load) vs. the % development and use that relationship to predict the load from those land areas that are draining directly to the Bay.



Ted Diers: Going back to some of your other research about groundwater concentrations of N…. There is essentially a sink that sits in shallow groundwater and it makes little difference if you have septic or no septic. Curious if you tracked any of that groundwater data and if during drought you have less flushing.

Michelle: We have started to look at shallow groundwater data and we see a flushing effect from floods such as in 2006 and 2007, but it has been building up since then. We have sensor data measuring nitrate every 15 min. During storms, we are seeing that, at the beginning of the storm, that the nearby groundwater flushes and then declines but does get diluted out with higher flows.

Rob Roseen: When I was working with Ballestero as part of the 2004 work… the second part of that effort was age-dating of the groundwater, in the intertidal zone. We estimated that the groundwater was around 20 years old, so the land use that was affecting that water was late 70s early 80s.

Next couple months:

Atmospheric N Deposition

2012 SOOE Report (2009-2011)

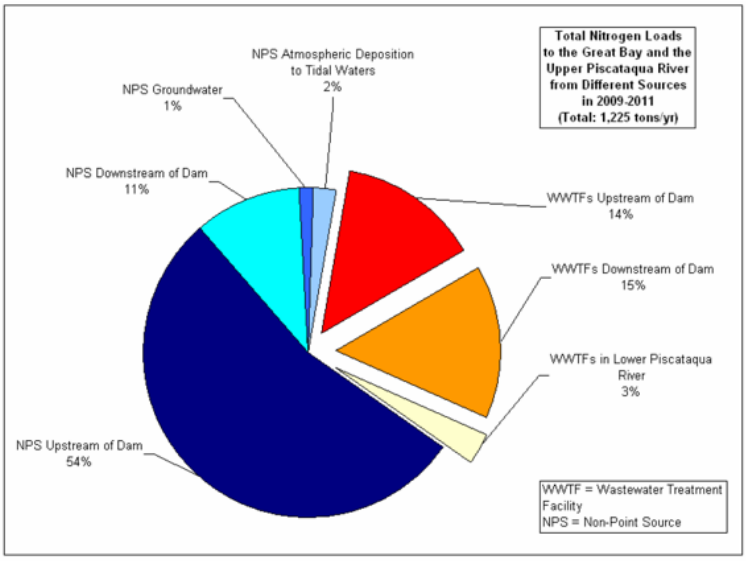
- Average deposition rate by Daley et al. (2010) was 2.11 tons/mi^2/yr.

2017 SOOE Report (2012-2016)

- Annual wet deposition provided by Shattuck et al. from wet deposition station at Thompson Farm in Durham, NH
- Great Bay Nitrogen Non-Point Source Study (NH DES 2014)
  - Determine average atmospheric deposition directly to the estuary

Update when all WWTF and NPS data are complete

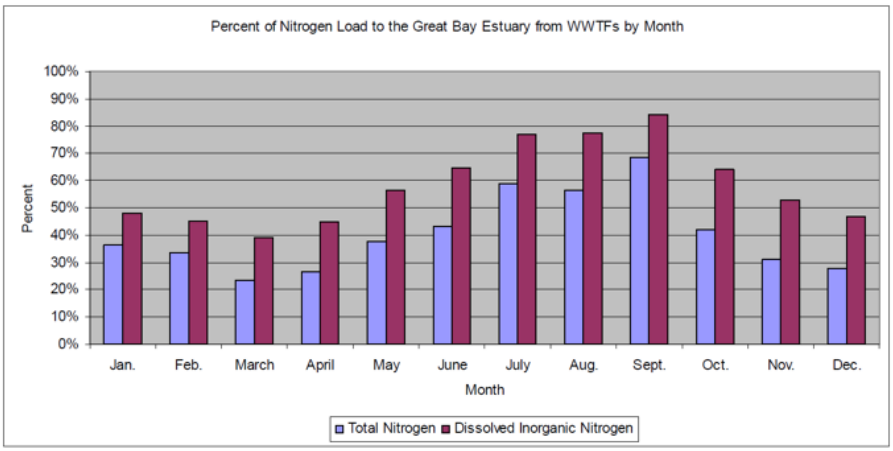
Figure NUT1-5: Nitrogen loads to the Great Bay Estuary from different sources in 2009-2011 (A) Total Nitrogen



Michelle: We'll update this chart as well with the new data.

Update to show % of seasonal TN and DIN from WWTFs and NPS (change bar color to WWTF vs NPS)

Figure NUT1-6: Percent of nitrogen load to the Great



Growing season vs. non-growing season

Michelle: We'll update to show % of seasonal TN and DIN from WWTF and NPS (change bar color to WWTF vs. NPS) – look at point sources vs. NPS. Bit hesitant to break down on a monthly basis. Flows for tidal trib stations are estimated…annual estimates are more reliable. Might want to look at a growing season vs. a non growing season.

Terry D: How is the DIN higher than TN?

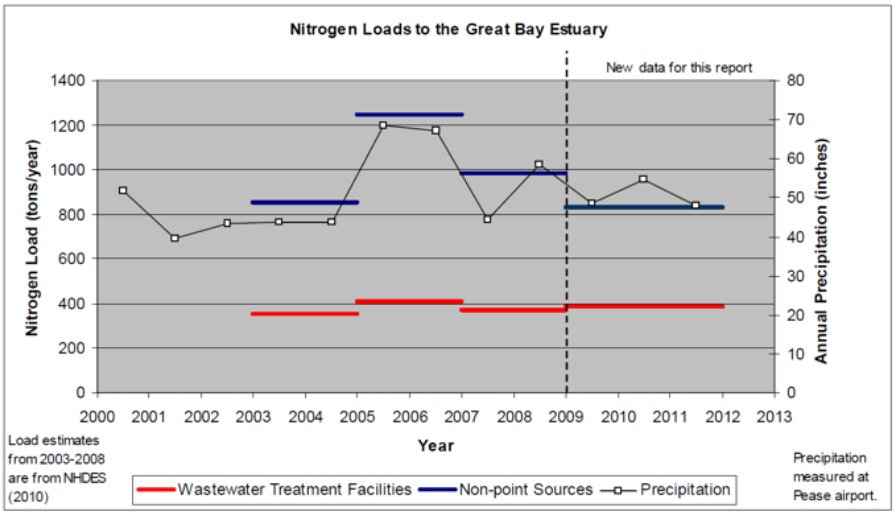
Michelle: % delivered by just WWTF. So, for each bar, you have to do the math to figure out the NPS load. For example, in Jan almost 50% jof DIN was delivered by WWTF…that means the rest was delivered by NPS. In September, on the other hand, almost 85% of the DIN loading comes from treatment plants.

Wil: Be careful of how you change this graph because it really does show how the WWTFs really dominate during the growing season; that is really an important message.

Update when all WWTF and NPS data are complete:

Figure NUT1-7: Trends in nitrogen loads and precipitation from 2003 through 2011

Annual loads 2012-2016



Michelle: Update when all WWTF and NPS data are complete (Fig. NUT1-7) present the annual…WWTF loads are in red (TN loads) and NPS in blue and can see how the correspond tightly with precipitation. Extend out to 2016 and include annual WWTF data and NPs and annual precip. Add the average if we want to keep that going but it's important to show the annual data.

John Hall: Suggestions: looking at rainfall patterns changing in 2004, the rainfall went up dramatically in the summer. Compared to historical conditions the amount of NPS loads that came in the summer was much higher than usual. I can send you a preliminary analysis I did of that.

Wil W.: What is the average precipitation?

John Hall: 42 inches, I think.

Wil: So , that whole data set is above average.

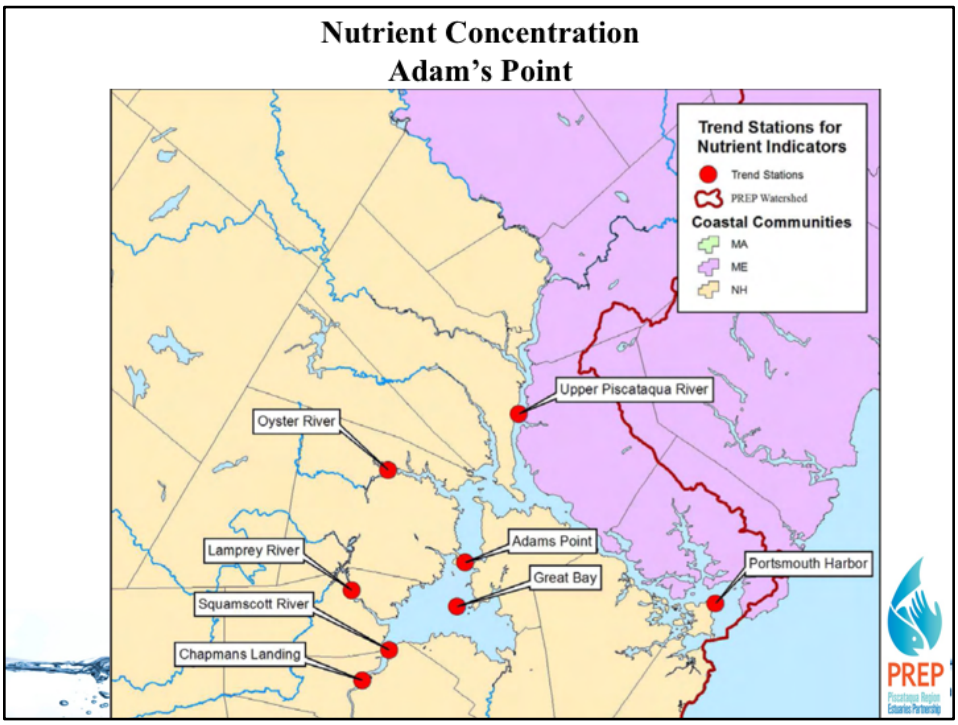
Toby: General comment…heard so many diff. ideas and caveats on this loading data. How are you going to capture that and explain all of those caveats.

Kalle: All of the notes will be captured and sent out to everyone. How does that get into the SOOE and Data Report. More will be in the data report. As much space as we need we take it. A lot of what is being said will be captured there. If it requires new analysis…and we don't have the time to do it maybe it gets done next time. SOOE is a 45 page document so we will have to choose the major messages. Hopefully you all will get to see how those choices are being made there.

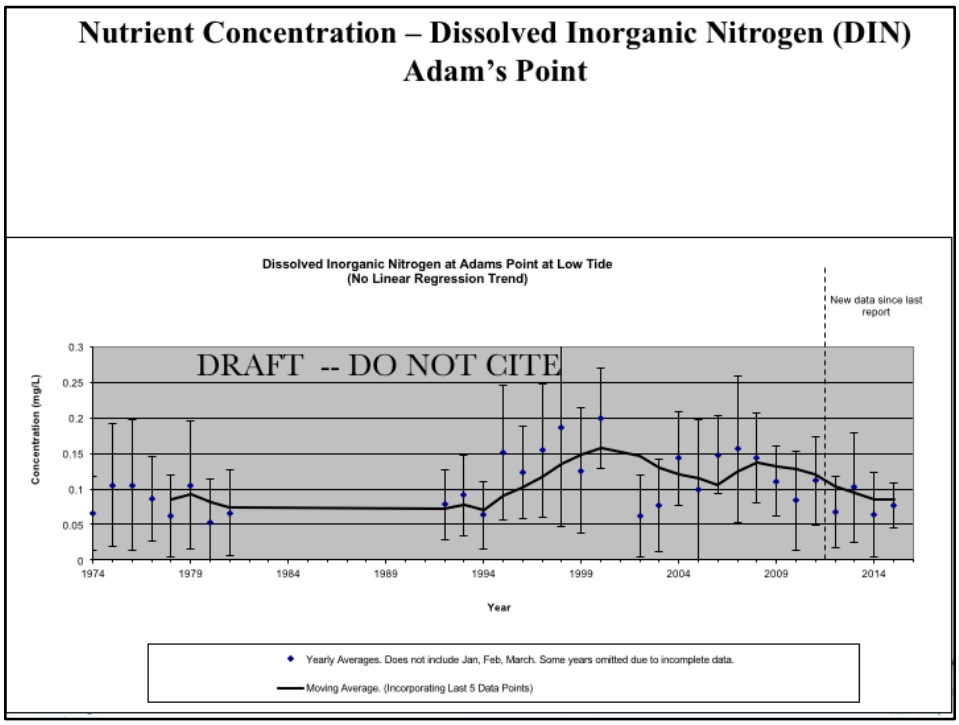
Wil: Address one of the caveats – frequency of sampling. Looking at annual loading measurements…and annual time periods there is not much of a change. Yes, there is variability with fine scale measurements, and after storms, but it doesn't affect (greatly) the annual. That is not a weakness in this analysis.

Erick: Important thing is not just showing these variables, but also putting into a form that you can overlay in the end to see when one goes up and one goes down. This is just data points. When we get a flush of water…what happens when it gets out there. What is the lag time? How does it affect eelgrass? At low tide a 4" rainstorm what does that do to the bed in terms of resuspending solids and what does that mean for the long-term?

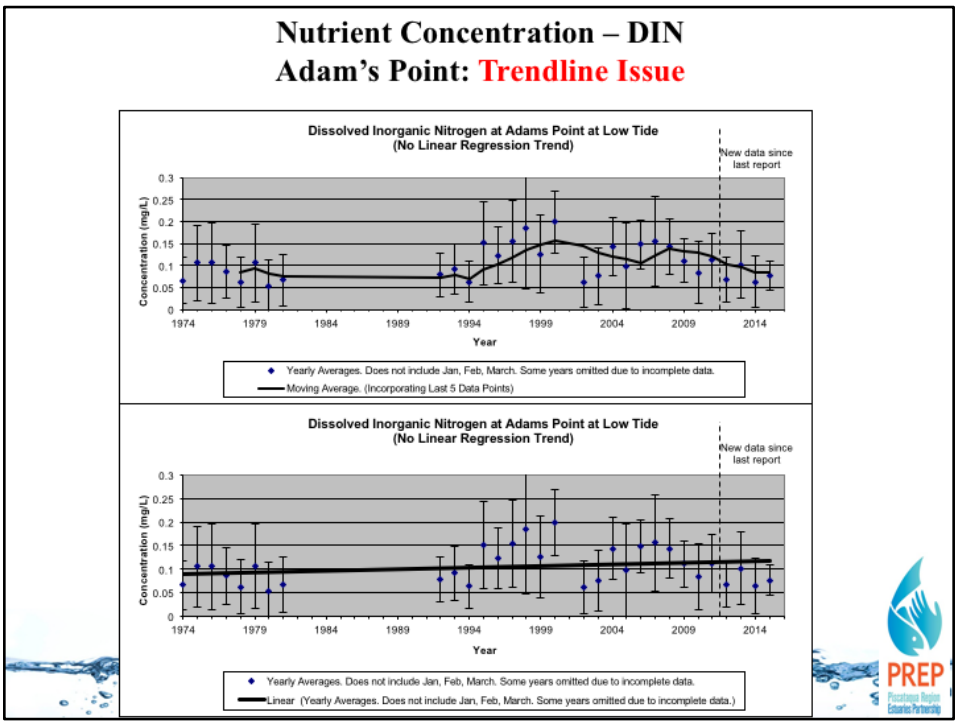
Kalle: In general the data that you are getting is long term monitoring data, and as a community we have to face the fact that we lack the resources to do that type of analysis that you are talking about. Some people are doing this, like Wil, but it takes resources and time to incorporate that. We are resource constricted. Point well made. We've put in proposals to look at this stuff in a high res way…we are going to keep at it.



Kalle: Ok, switching gears now to looking at nutrient concentrations in the water column, derived via grab samples at the stations shown in the slide above. Remember that when you see nutrient concentration numbers, you're only seeing a portion of what's going on, because so much of the nutrients get taken up immediately by plants and microbes. The "Total Nitrogen" parameter—as opposed to inorganic--is a bit more comprehensive because it also picks up nitrogen in phytoplankton.



Kalle: On this first slide, let's talk about some formatting issues. I recognize that the phrase "no linear regresssion trend" is awkward. I'll change that. The other issue I want to talk about for a second is the trendline. Instead of using a linear trend line, I felt it was more descriptive to use this moving 5-year average, and to use it whether there was a statistical relationship or not. See next slide.



Kalle: On this slide, you can see a comparison of the trendline options. What do people think?

Paul Stacey: At the first meeting, Keith Robinson from USGS suggested that rather than a point, you do a bar and whisker graph so it offers more insight on the variability of the data.

John Hall: I also wonder if there's a way to better handle outliers.

Rob Roseen: I agree regarding the box and whiskers. You could add summary stats like a sparkline. To address the outliers, you could consider using the median rather than the average. At the end, add a summary stat that shows the max and min. With regard to the R-Squared value…it's good to know but you don't want to be a slave to it. Also, you may want to always provide a trendline and always provide the r2 and pvalue for the x-variable.

Erick: I have a question on a different subject. Are these are all datasondes samples?

Tom Gregory: These are all water grab samples from ½ meter depth.

Eric: How does that correspond to actual depth?

Kalle: Of course, depth is variable with tide. In the data report…all of this is low tide only. Done in previous years because work in the 1970s was done in low tide only. We wanted to compare apples to apples. John Hall asked why we wouldn't use tidally

averaged? Could also look at mid ebb or mid low…That's a question for the group. Might not be able to do this year, but could for the next year.

Erick: It seems like different depths will get you different data; it's important.

Tom: I agree. We wish we had more data, but…we get one depth.

Paul Stacey: Since the purpose of the data is to determine trends, I favor using the low tide data because it minimizes different factors. If you want to understand nutrient dynamics then you look at all of the data.

Wil: I agree. In sampling at low tide you get the maximum watershed signal. Including at Adams Point. Something to bare in mind. Do you actually have data at the high tide? On the same day?

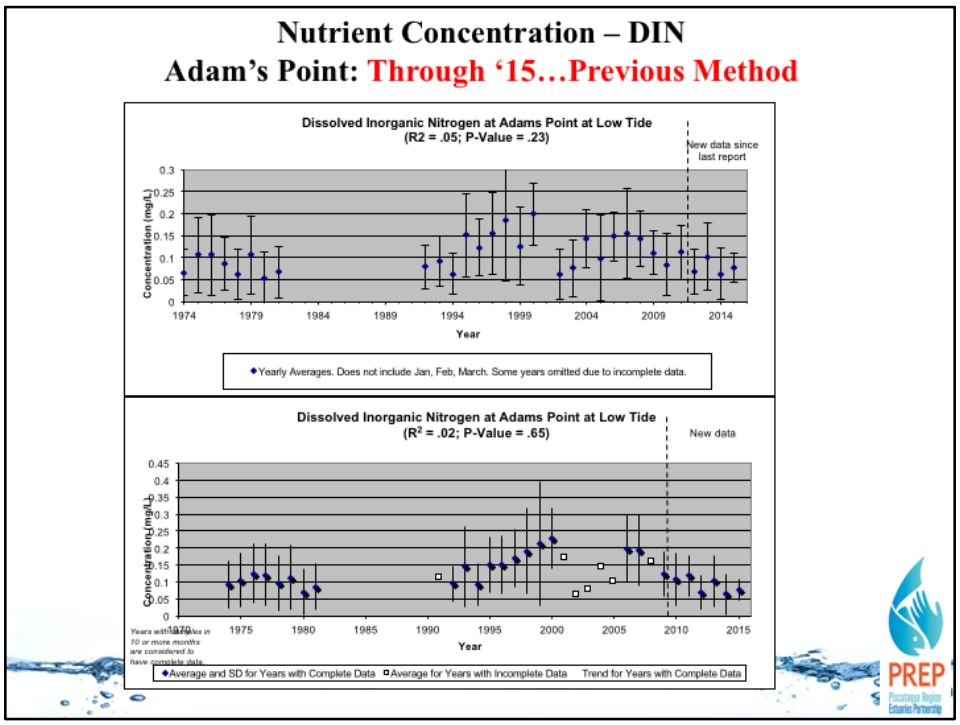
Tom: Same day. But only a subset of the stations are sampled at high tide.

FredShort: Erick was asking about stratification, our general assumption is that the system is well mixed.

John Hall: Let me explain why I was concerned about the low tide readings. Depends on parameter and location on how much this really skews what you are seeing out there. TSS is particularly screwed up at low tide. System is shallower, with wind you get more stirring…at low tide you might think it's a signal from the watershed and it's not.

Fred: In addition to this grab sample data we also have continuous monitoring…will that be included? It's some of the best data we have.

Kalle: For this year, we are working on getting the data from the NERACOOS Great Bay Buoy, but that's just for CDOM. We won't have time to qa/qc all of the nitrate data. That will have to wait for future years.



Kalle: Next, I want to talk about this issue of when to include years and when not to. For shorthand, we can call this the "complete" issue. You can see on the bottom chart that Phil had some data points that were white…don't have standard errors. They are shown but not included in the statistical analysis. What made something complete or not was the number of samples in a year. Adams Point sampled year round. Phil said at least 10/12 samples to be complete. Some places they only sample April to December and there you needed 7 samples. Kind of arbitrary…depends where the missing data points are. Suggested to think about it more seasonally. Because there was no sampling done in 2002-2005 you lose those data points. Most other programs don't look at Jan, Feb, March. Most look at April through December. If we do we will get those missing years back into our dataset. If you are missing 3 months in a row you are missing a whole season…it will screw it up more

Matt: Is there a compromise? 2001 shows no data up top and a missing point. Important to know that data was collected during that year vs. the 1980s when the data was not collected.

John Hall: Completely agree about taking out the winter months. In the end you are providing ecologically meaningful data to the public. We run our systems to remove nutrients during the growing season because that's when the affect is. If you keep the data in when it's not affected…you are missing the full story of the growing season reductions.

Fred Short: Don't totally agree with that…a lot of the bloom activity is late February

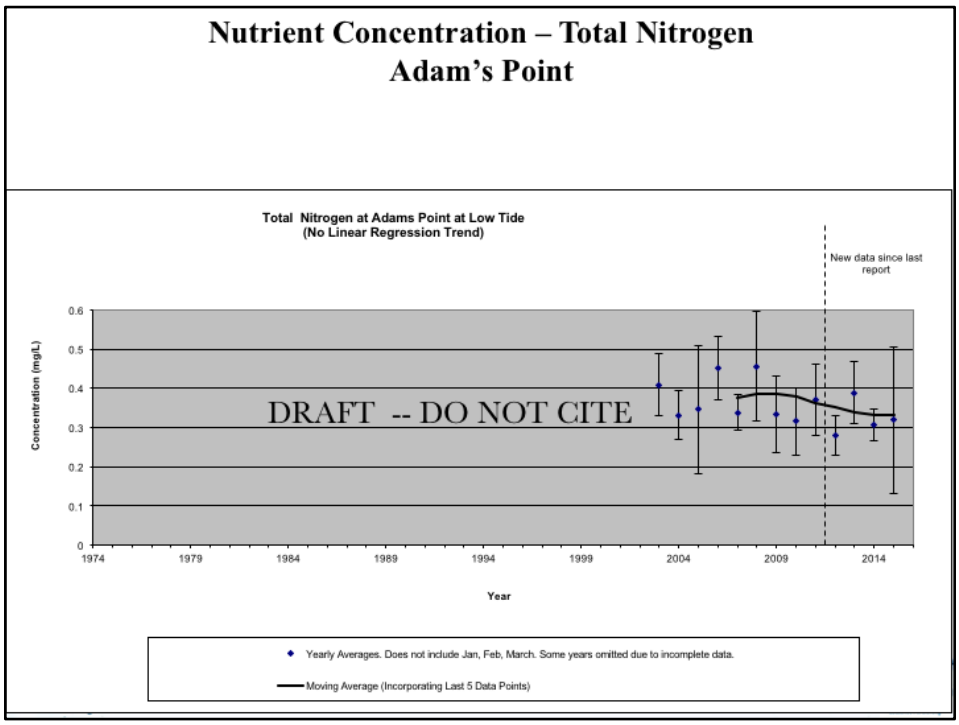
and beginning of March. That plankton production gets in the system and affects the spring and summer. Can make a difference.

John Hall: The data that I'm aware of does not support what Fred just said.

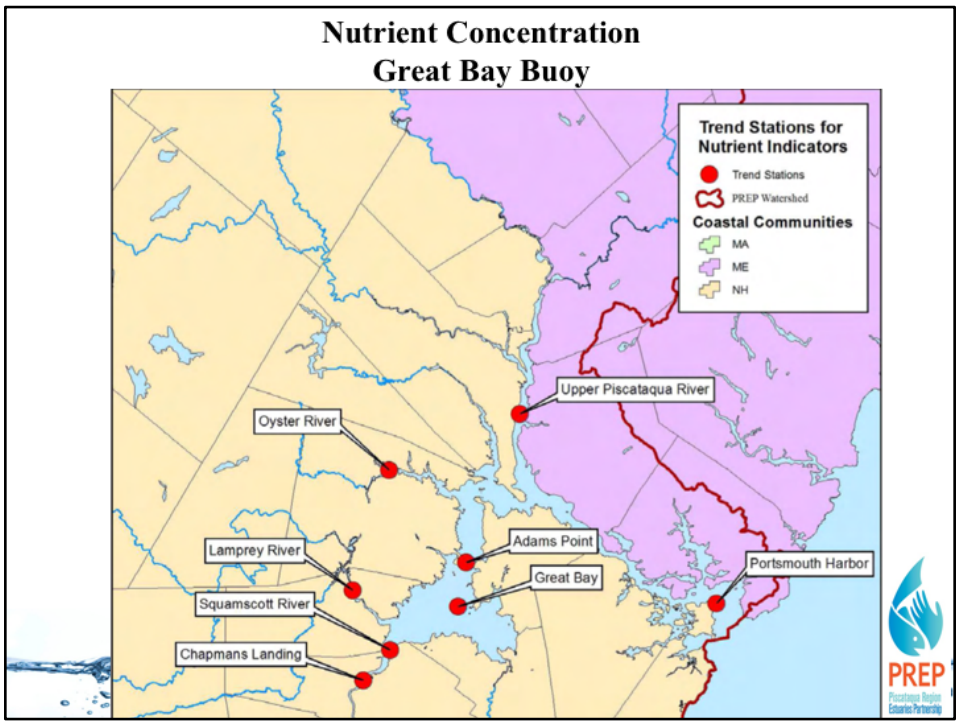
Kalle: We will get to the meat of that at the next meeting. It's a little bit of a separate discussion.

Rob Roseen: In general a good approach is to be as inclusive with data that meets quality control requirements and add assumptions and limitations. The more data the better. In my mind, what is a complete data set, when I look at that I'm wondering how important the level of completeness is. The more data points you have the more substantial your data set is. Not sure why you would exclude certain amounts of data. Just becomes more robust over time.

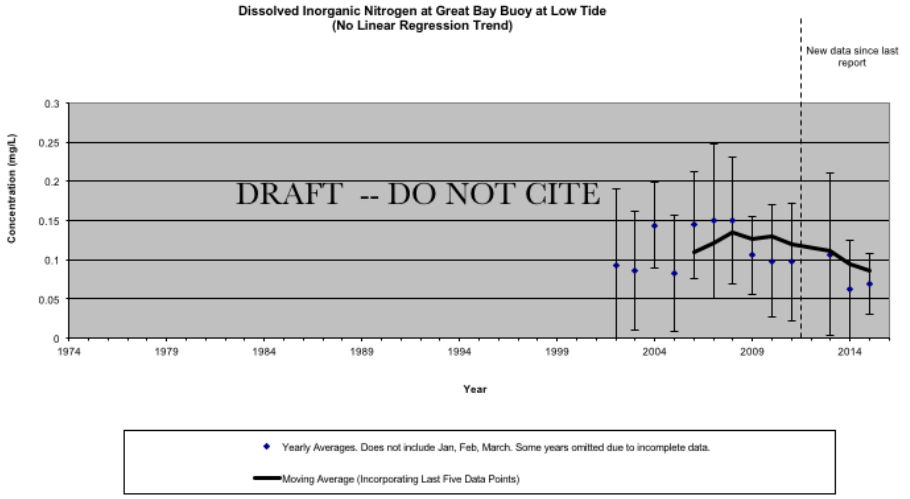
Ted: Same as the conversation of the wide ranges…the question is does it matter? That's where I hope PREP comes down to making this decision. If you do this and it makes no difference about the understanding you get…and one way makes it easier to understand.



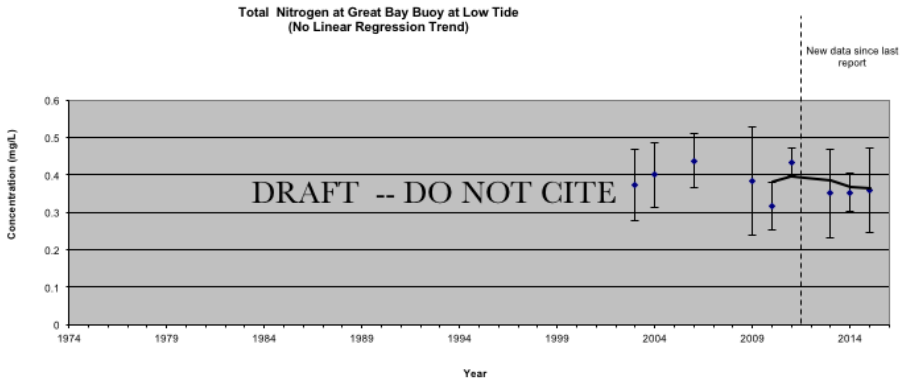
Kalle: Now, I'm just going to flip through the data slides so that peope can get a sense of the data.

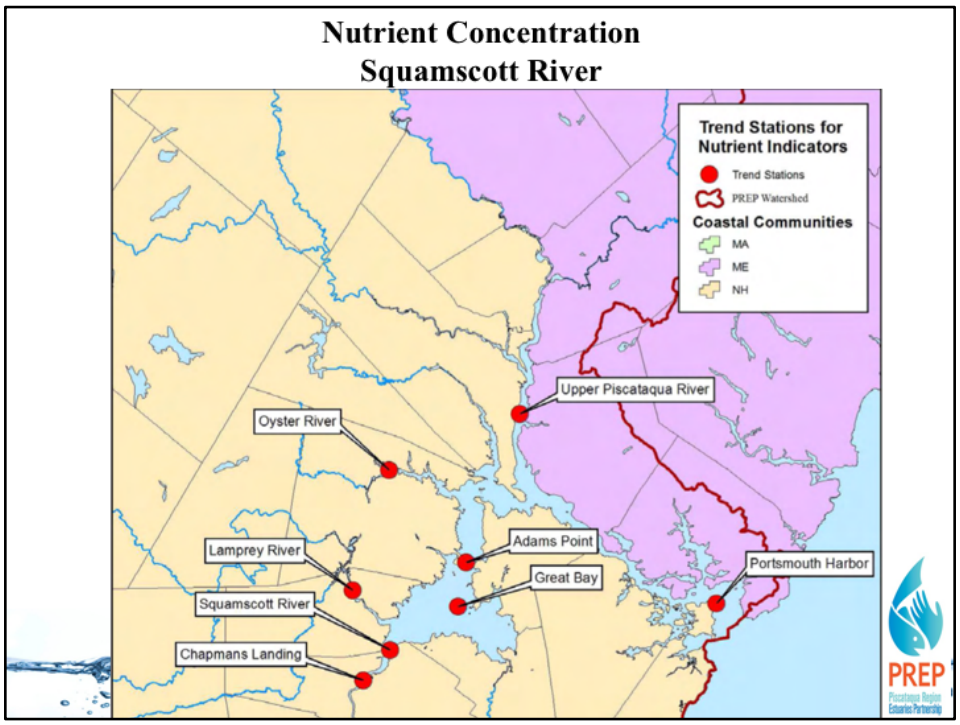

Nutrient Concentration
Great Bay Buoy
Trend Stations for Nutrient Indicators
Trend Stations
PREP Watershed
Coastal Communities
MA
ME
NH
Upper Piscataqua River
Oyster River
Adams Point
Lamprey River
Great Bay
Portsmouth Harbor
Squamscott River
Chapmans Landing
PREP

Nutrient Concentration – Dissolved Inorganic Nitrogen
Great Bay Buoy



Nutrient Concentration – Total Nitrogen
Great Bay Buoy




Nutrient Concentration
Squamscott River
Trend Stations for Nutrient Indicators
Trend Stations
PREP Watershed
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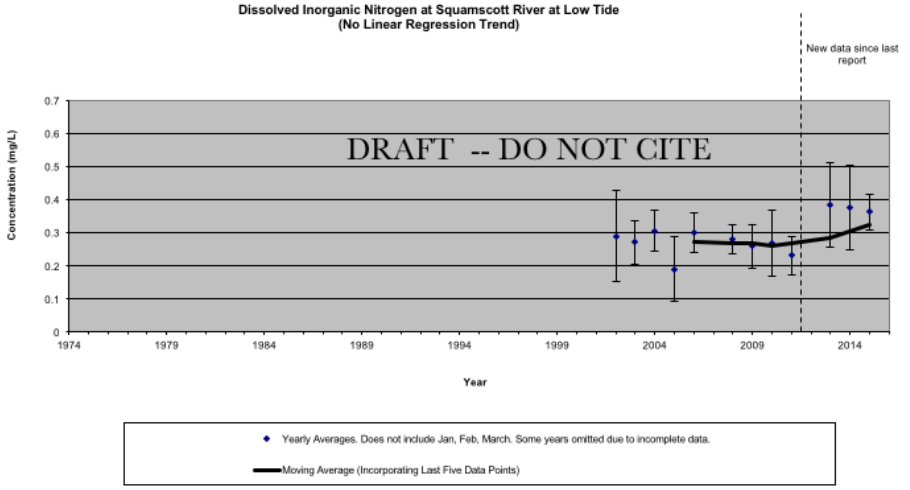
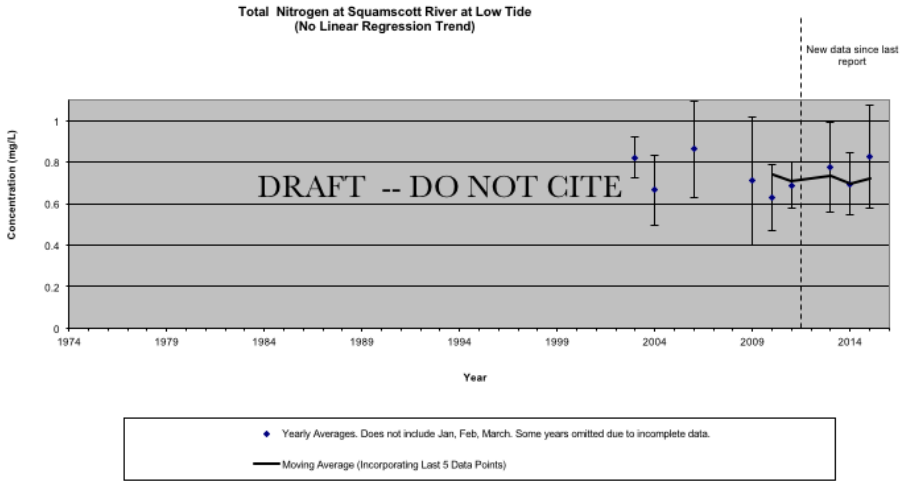
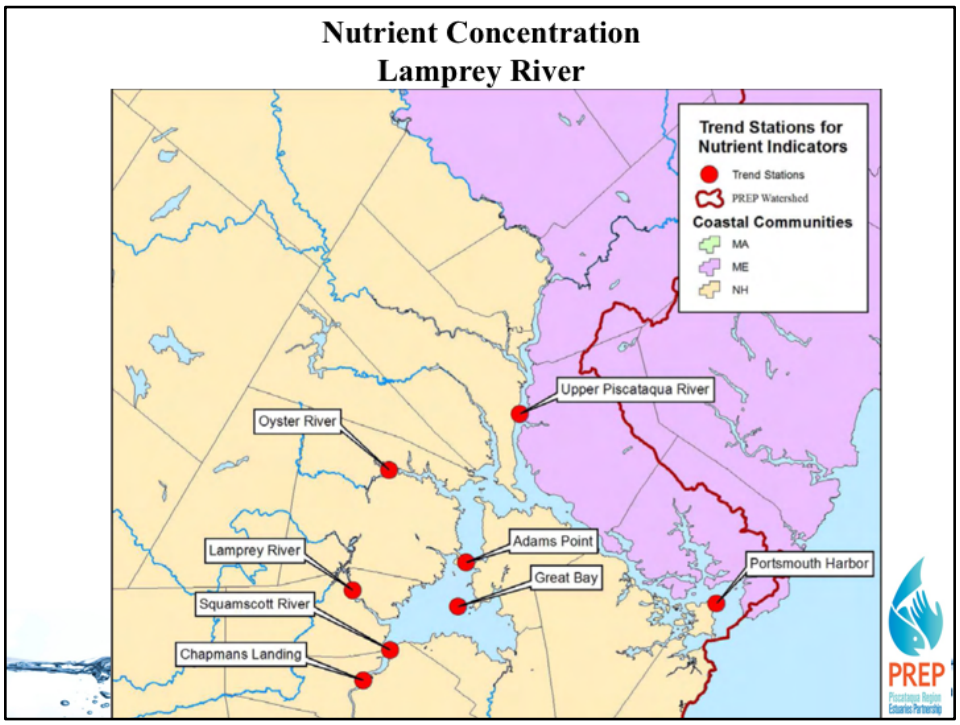
Chapmans Landing
PREP

Nutrient Concentration – Dissolved Inorganic Nitrogen
Squamscott River



Nutrient Concentration – Total Nitrogen
Squamscott River




Nutrient Concentration
Lamprey River
Trend Stations for Nutrient Indicators
Trend Stations
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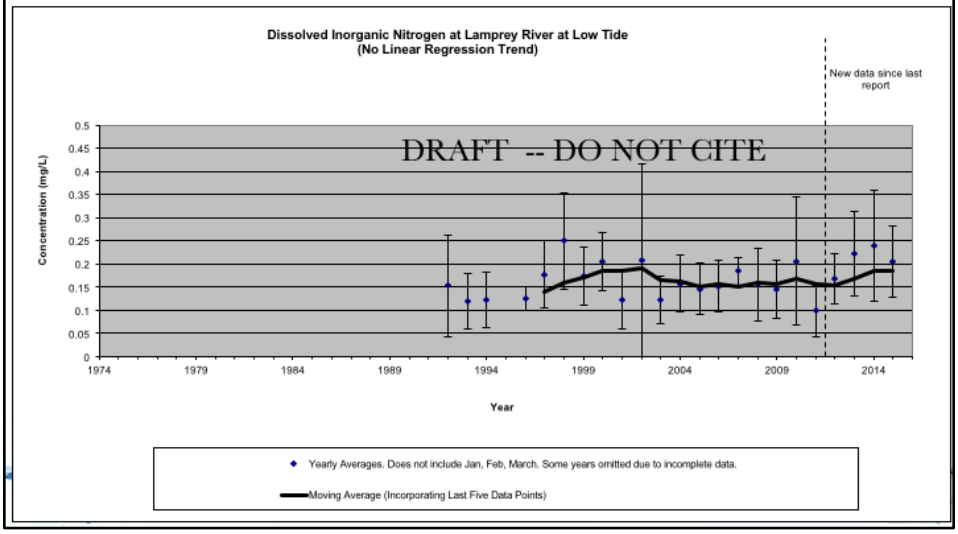
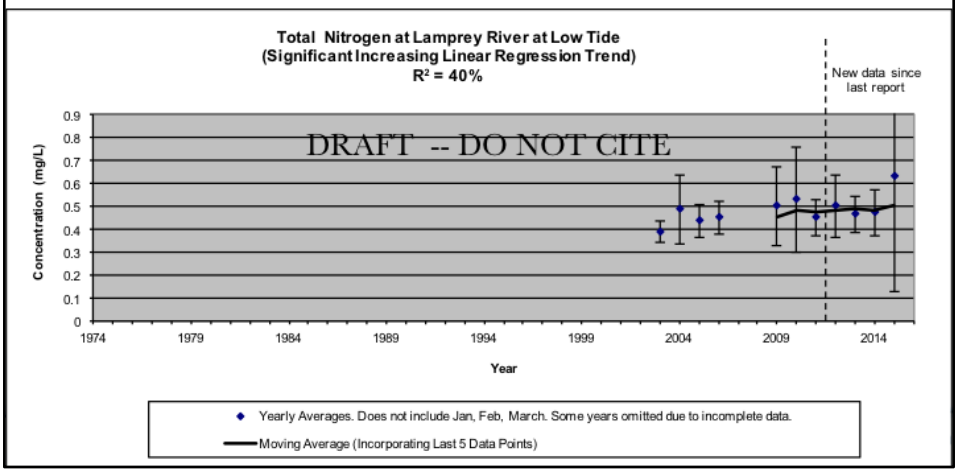
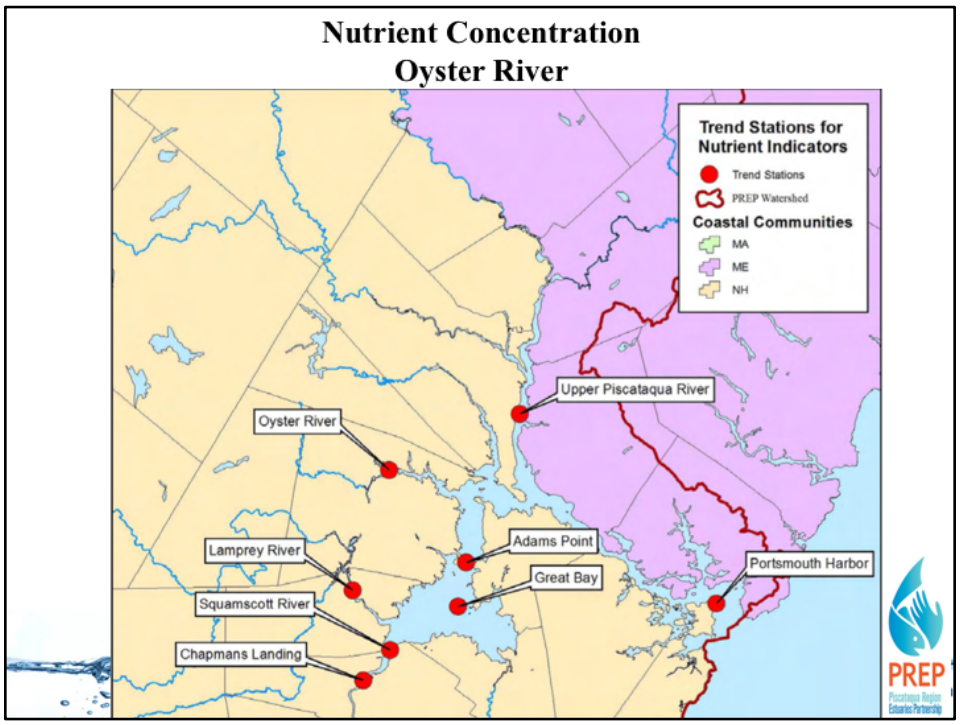
PREP

Nutrient Concentration – Dissolved Inorganic Nitrogen
Lamprey River



Nutrient Concentration – Total Nitrogen
Lamprey River




Nutrient Concentration
Oyster River
Trend Stations for Nutrient Indicators
Trend Stations
PREP Watershed
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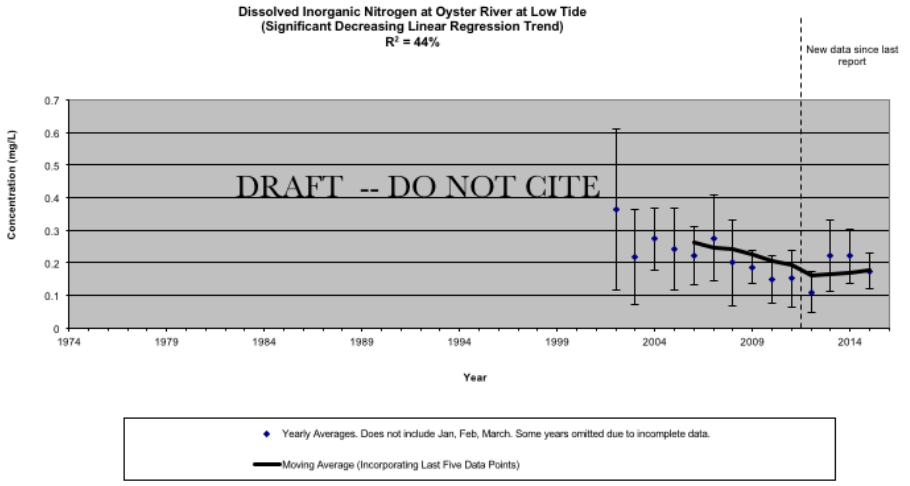
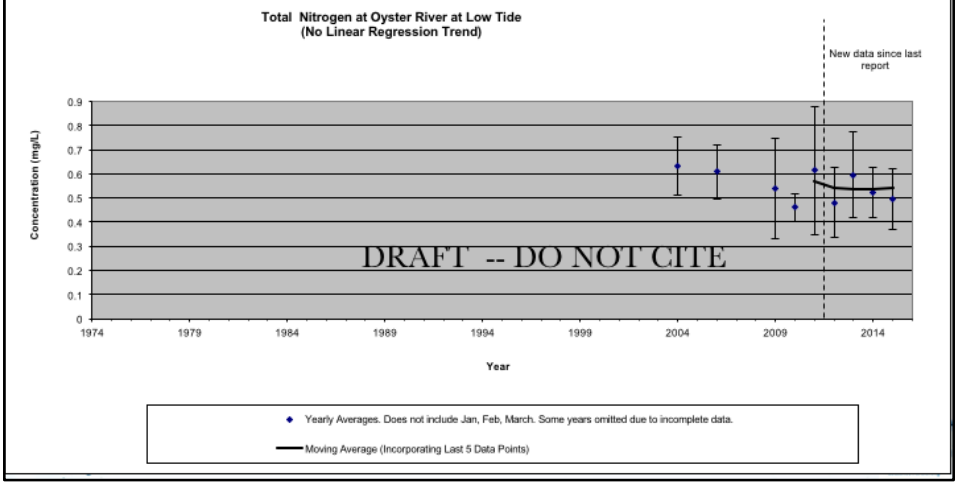
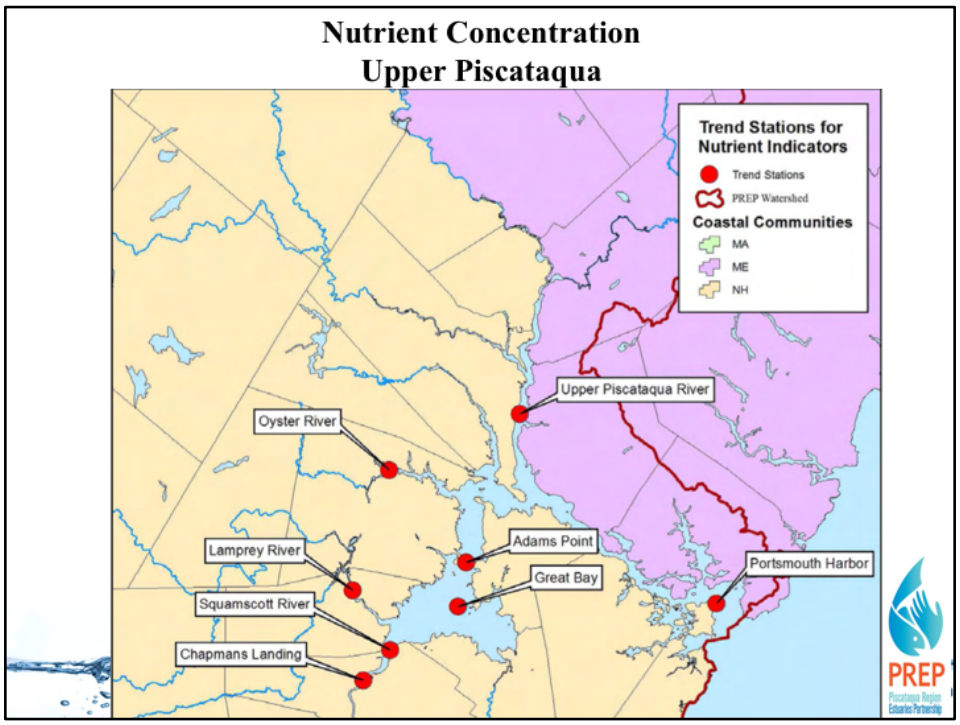
PREP

Nutrient Concentration – Dissolved Inorganic Nitrogen
Oyster River



Nutrient Concentration – Total Nitrogen
Oyster River




Nutrient Concentration
Upper Piscataqua
Trend Stations for Nutrient Indicators
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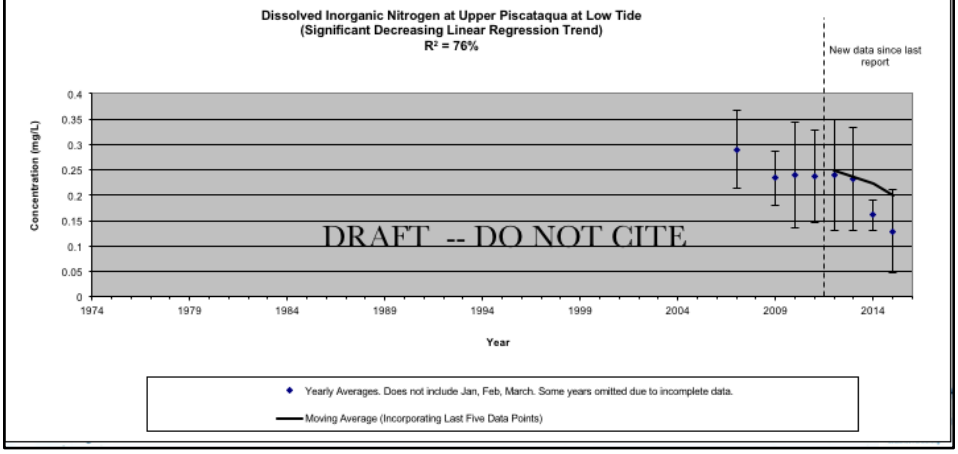
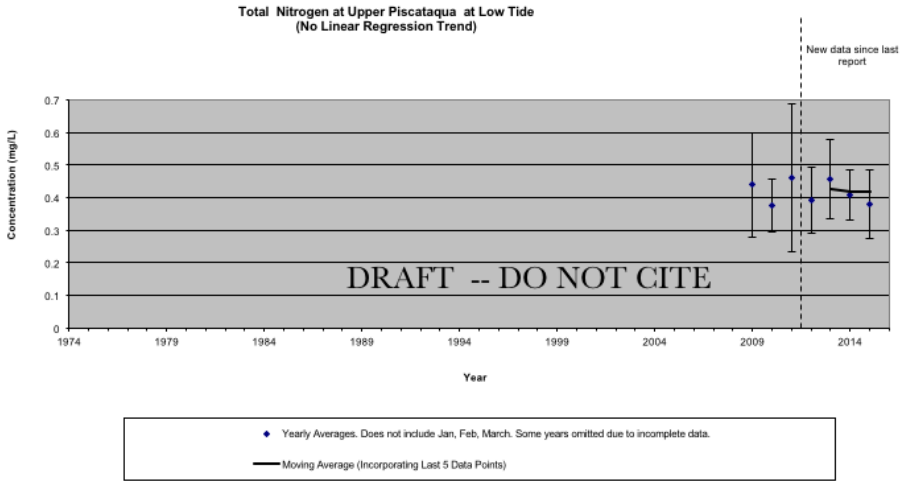
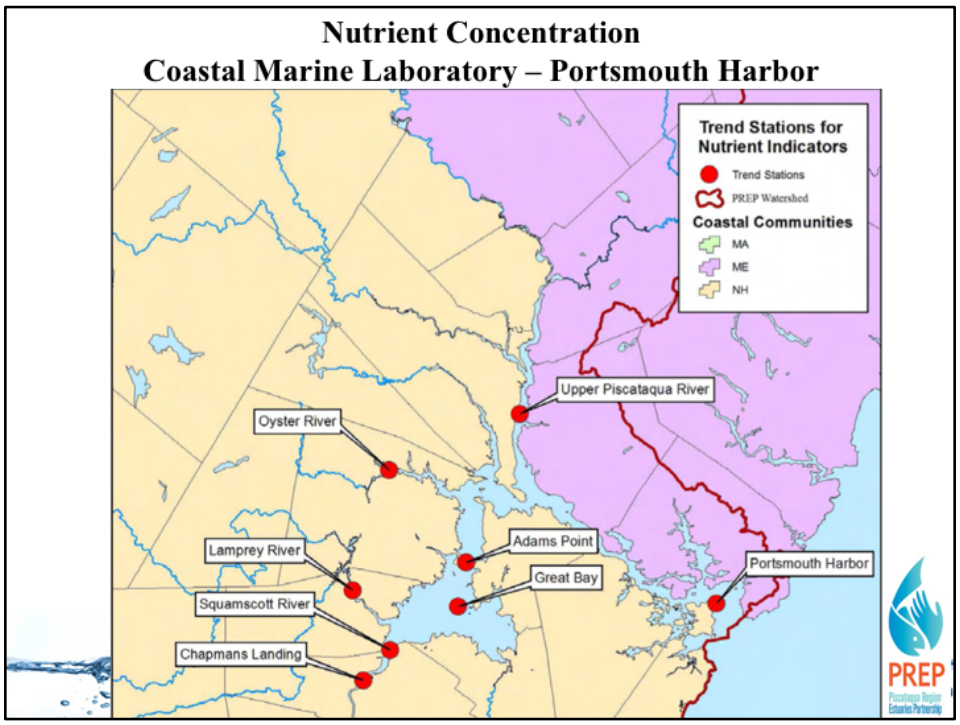
PREP

Nutrient Concentration – Dissolved Inorganic Nitrogen
Upper Piscataqua



Nutrient Concentration – Total Nitrogen
Upper Piscataqua




Nutrient Concentration
Coastal Marine Laboratory – Portsmouth Harbor
Trend Stations for Nutrient Indicators
Trend Stations
PREP Watershed
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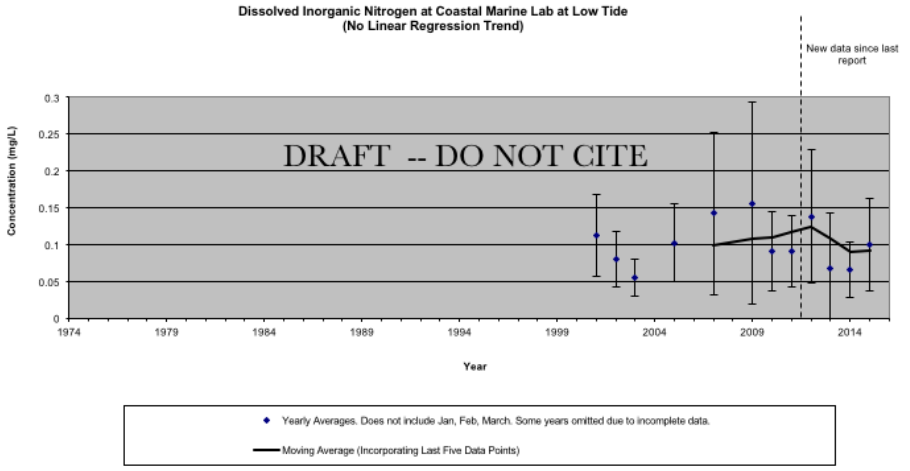
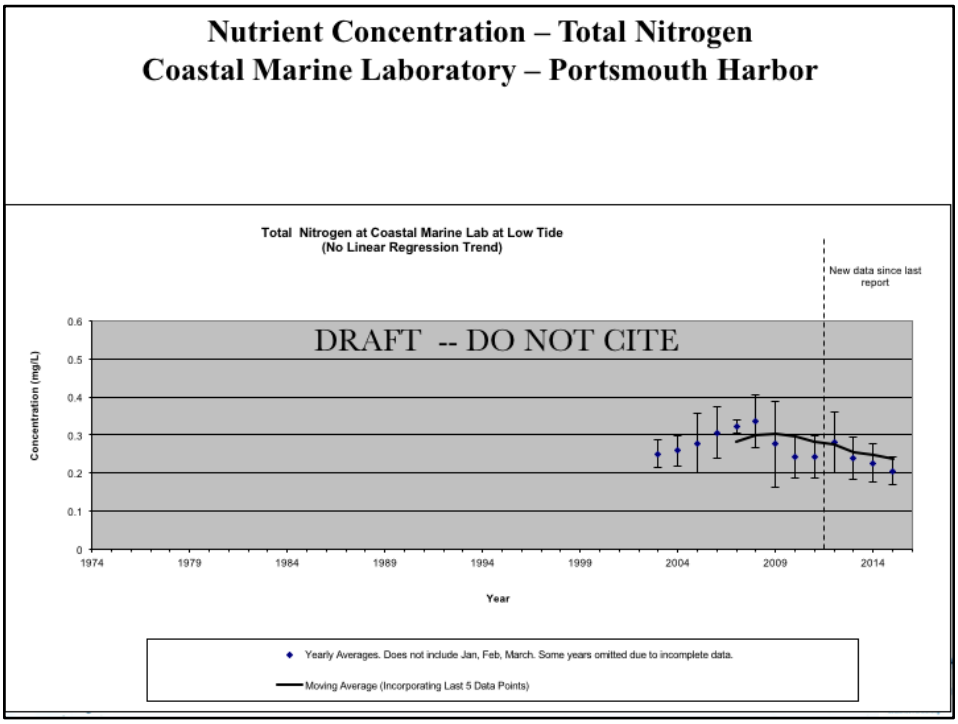
Nutrient Concentration – Dissolved Inorganic Nitrogen
Coastal Marine Laboratory – Portsmouth Harbor



Nutrient Concentration – Total Nitrogen
Coastal Marine Laboratory – Portsmouth Harbor



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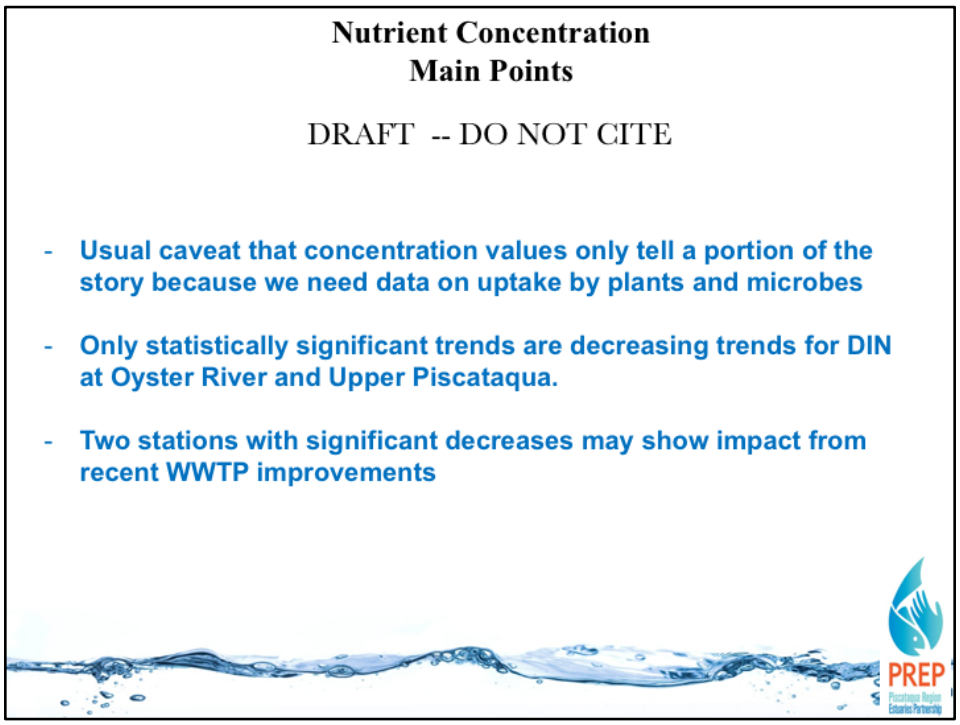
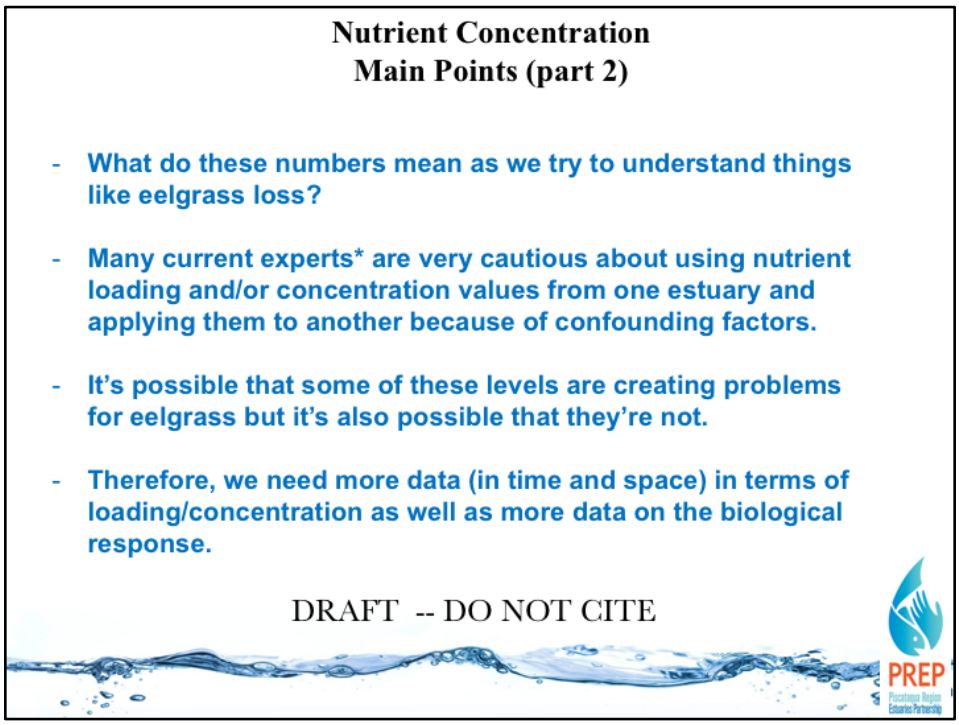


Kalle: Here are some main points I would emphasize from these data. Thoughts?

John Hall: Again, I wouldn't limit yourself to looking at five-year patterns, when we know some very significant things happened in the latter portion of that period, in terms of nitrogen reduction.

Erick: Given where Durham's outflow is in relation to the sampling station, I think you should be careful about that last statement.

Wil: A related comment…if you look at NPS delivery over same time period you'd also see a trend. Evaluating if its NPS or P,S you want to compare the regressions to see which had the stronger signal.



Kalle: And here are some additional points. Just to expand on this a bit….How do you put these data into context? Numbers don't mean anything to many folks without a little context…We don't have a qualitative analysis developed for this estuary. We can't say exactly how much nutrient loading or concentration is too much for our system. So…how do you make sense of the numbers? The way to look at this is mechanistically. What's the relationship between the different stressors and the biology. It's possible that some of these levels are problematic for eelgrass and some may not be. We'll dive into that more in May. Need more data to say what these numbers mean. In the data report we can say in some systems these levels are TOO MUCH…and in other systems it's fine.

Fred Short: Concentration values don't tell you the story. Chesapeake Bay has different levels because it's stratified and deeper…it's different. The DIN values plants are exposed to in Portsmouth Harbor are different from what's being seeing on the flats of Great Bay.

Rob Roseen: I applaud you for a carefully reasoned statement and we are wrestling with uncertainty. But I would delete the last sentence because it's a real cop out. We need more data…well yes and we all know that…but that doesn't get us off the hook.

Kalle: I want to clarify. My point is not to say we need more data before takig action. I'm saying we need more data to understand, but we can't wait for complete understanding for management. I realize that.

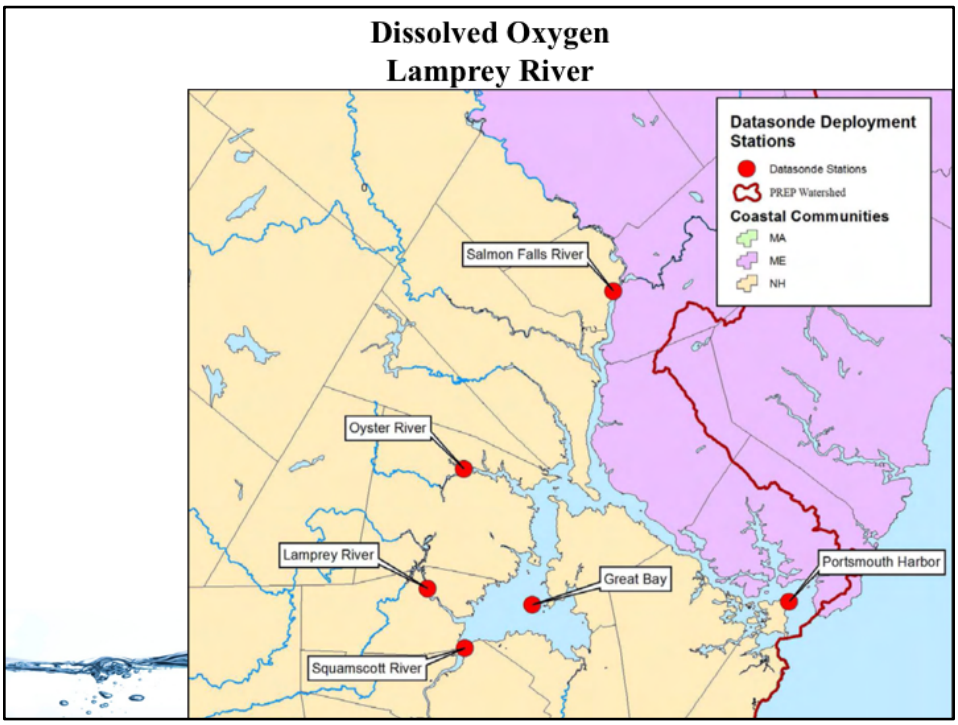
Rob: Absolutely, because you'll get data paralysis…the more we know the more we realize we don't know. 3D elements and time elements. People have seen this in other systems. Your understanding is not going to get more clear. We may realize the system is far more complex than we ever thought..

Paul Stacey: Bottom line that these questions go beyond what we need to do. We are trying to objectively look at data from trends. Are they going up or going down. Not the cause and effect relationships. You have your hands full with just the assessment…don't try to cram to much in terms of answering management questions.

Kalle: If we are going to take everything out that suggests what we should do as managers it will drastically change our SOOE reports. It is very different from what we have done. There are statements about what we should be doing. Are we really going to stop doing that? Sure, that would make my job easier, but…

Rachel Rouillard (PREP Director): As the NEP it is our job in the summary document--the SOOE report--to talk about what we are seeing and what that means and how that translates into action. Not going too far as saying what should be done, but rather what should be considered. That's the difference between the data report and the SOOE. The statements in the SOOE would be based on vetting of this data…any changes or messages that we need to be articulating. It's our job to provide that value added.

John Hall: I just suggest that you be a bit more clear about certain obvious things that need attention, such as the impacts of storms, which we know are going to impact the system. We had some of the worst storms in 2006 that this area has ever seen and that's when we lost a lot of eelgrass. That should be pointed out.


Dissolved Oxygen
Lamprey River
Datasonde Deployment Stations
Datasonde Stations
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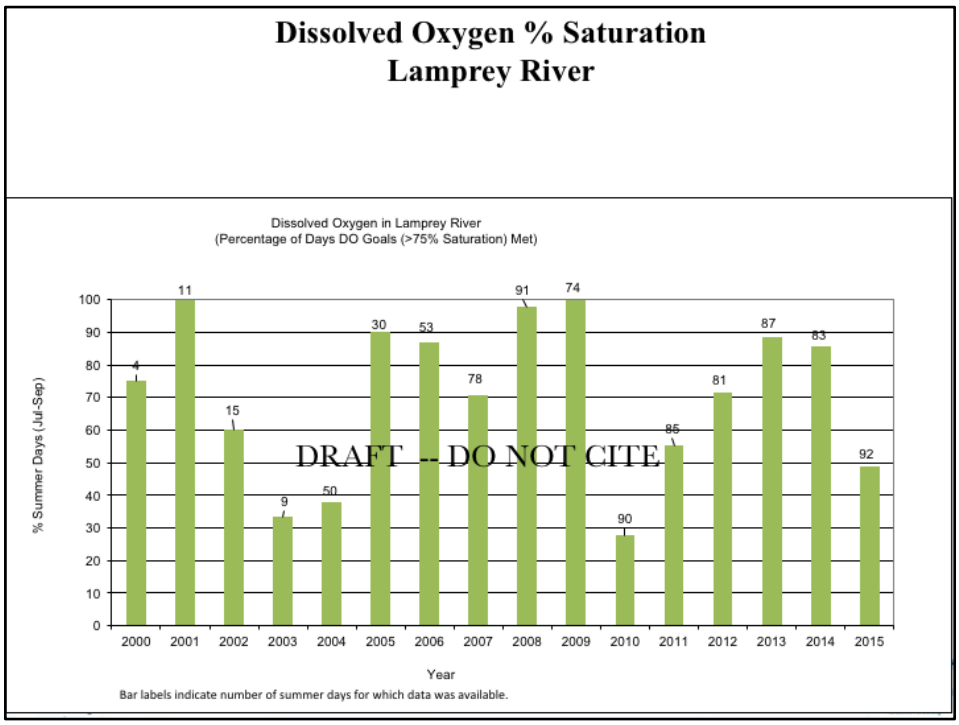
Salmon Falls River
Oyster River
Lamprey River
Great Bay
Portsmouth Harbor
Squamscott River



Kalle: A word on formatting before we continue. I labeled the bars to show how many days we had data for. Tried to take out the regulatory language. Number of days you met your goal (y axis).

Toby S.: I found this very confusing.

Wil: Whatever you go with, make sure the chart has units and is as clear as possible.

Kalle: Will follow up with you on it, because the other method was confusing.

Terry D: Is this still only low tide numbers?

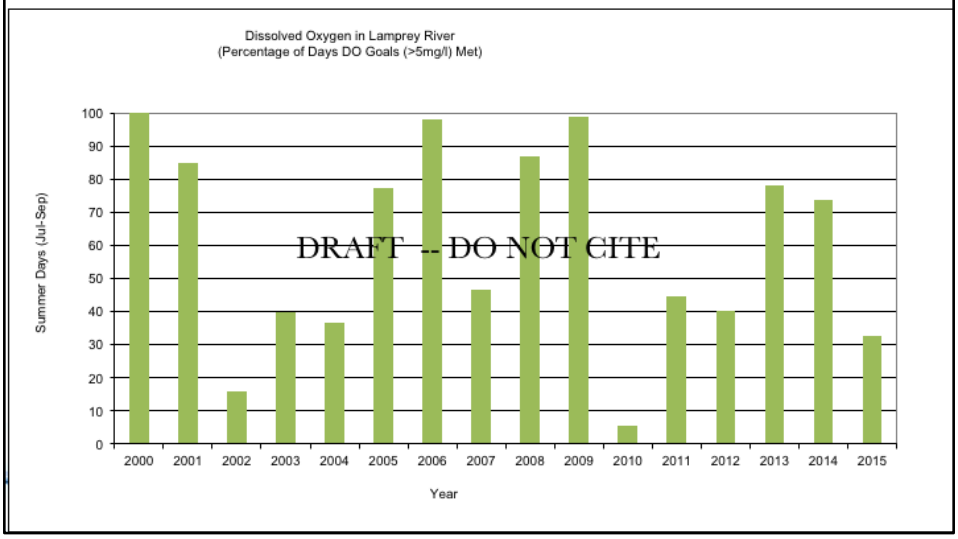
Kalle: No, this is datasonde data.

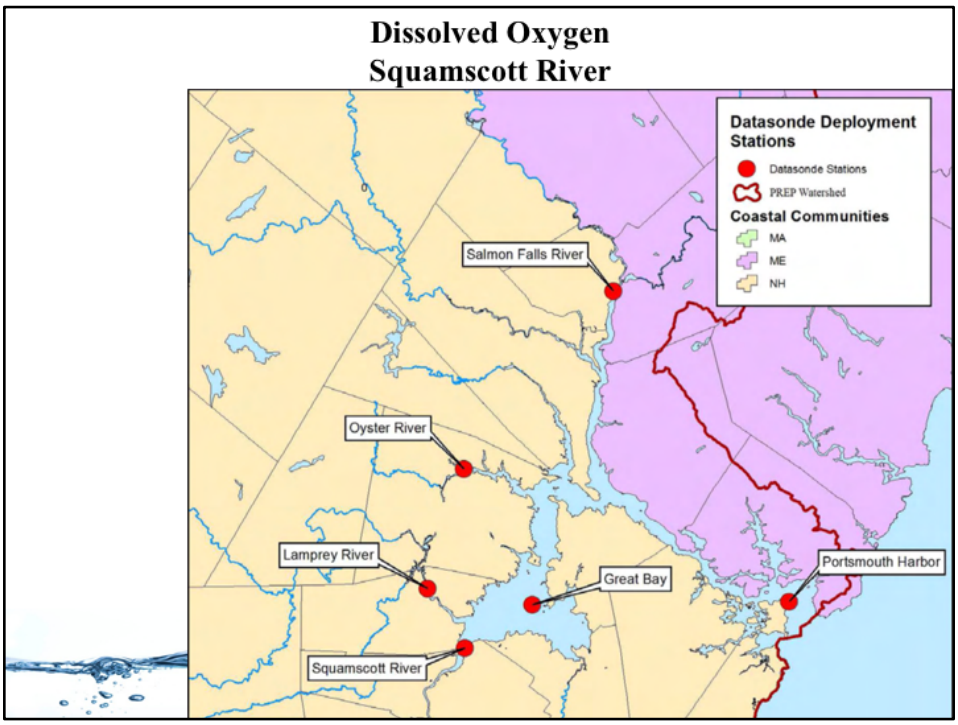
Matt Wood: To clarify, %saturation is a daily average and the concentration (mg/L) is a minimum for that day.

Paul: I'm not sure I like the change in flavor when compared to how you handled the nutrirents. Nutrients was compared in numbers, and DO is presented as thresholds. Could it be done as % saturation and then make a point about 75% saturation with a line across the graph. Could do the same with concentration.

Rob: I agree. I would replace the bar chart…less informative. Box and whisker with the standard it would be useful.

Dissolved Oxygen -- Concentration
Lamprey River




Dissolved Oxygen
Squamscott River
Datasonde Deployment Stations
Datasonde Stations
PREP Watershed
Coastal Communities
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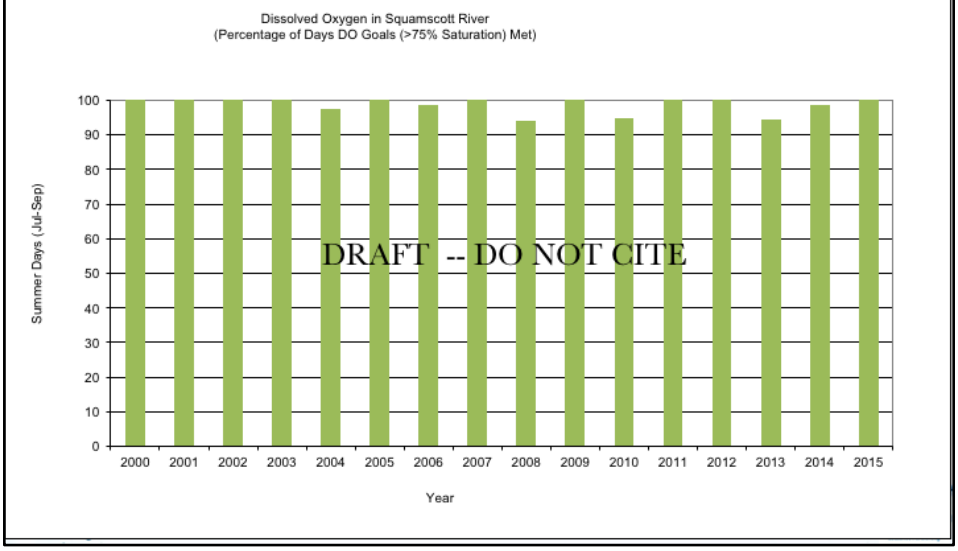
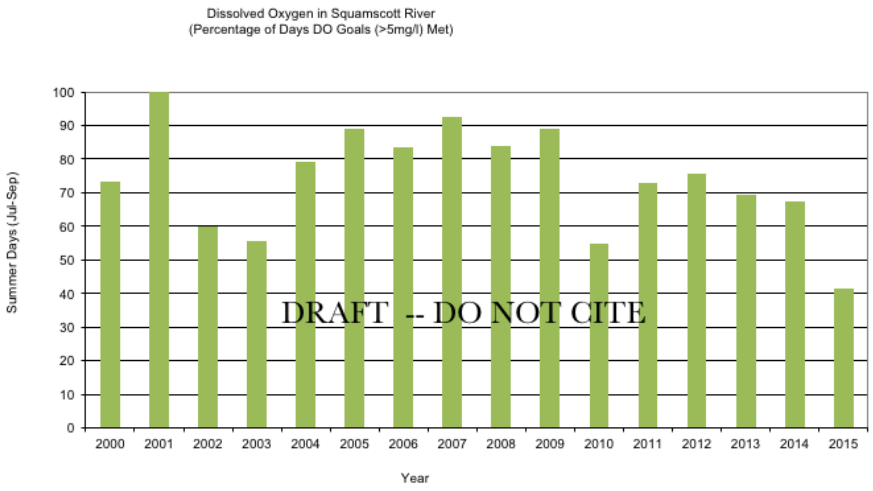
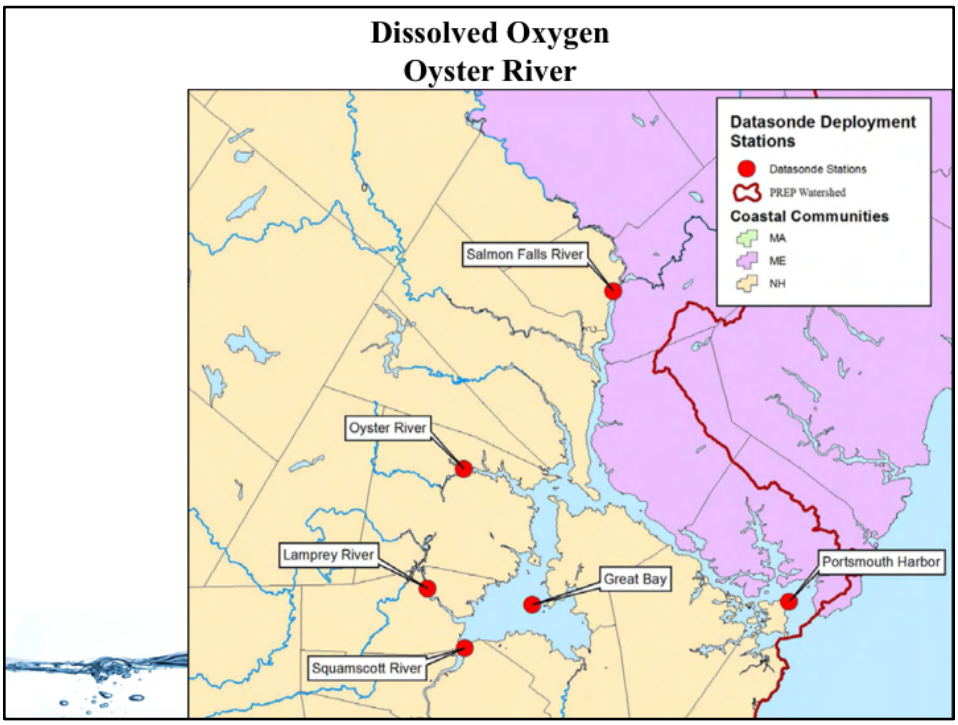
Salmon Falls River
Oyster River
Lamprey River
Great Bay
Portsmouth Harbor
Squamscott River

Dissolved Oxygen % Saturation
Squamscott River

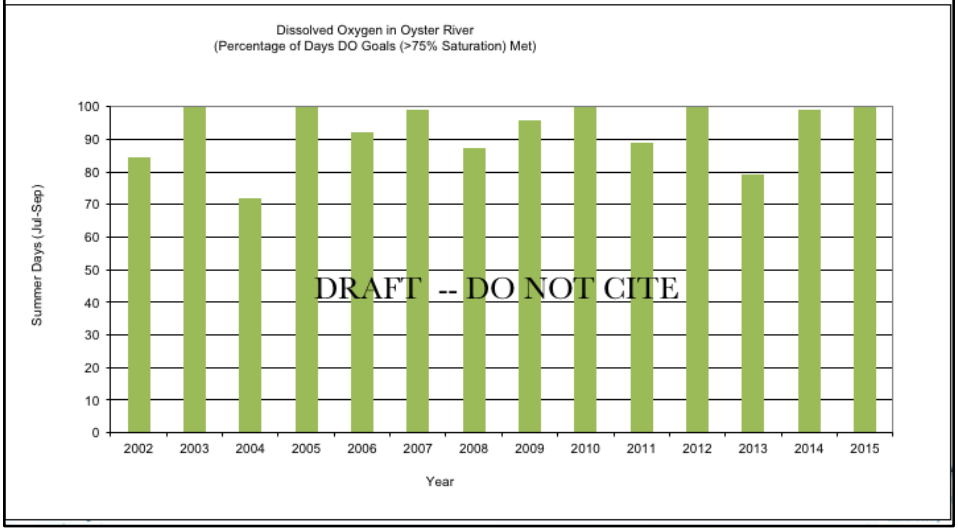


Dissolved Oxygen -- Concentration
Squamscott River

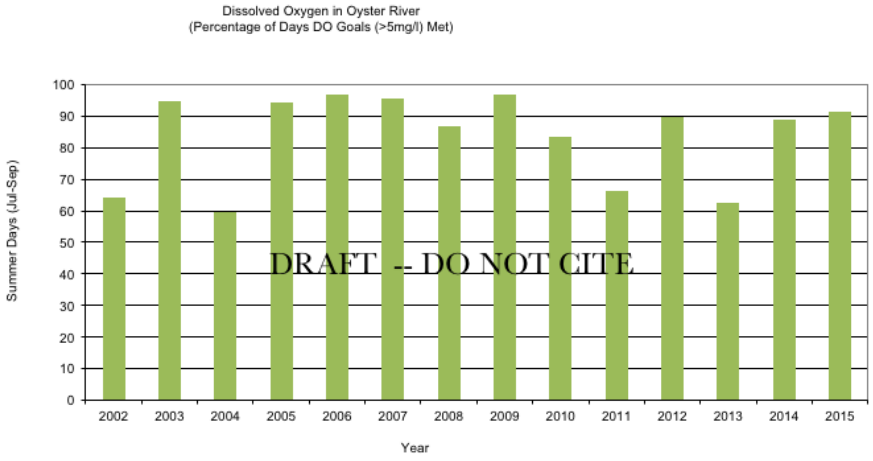


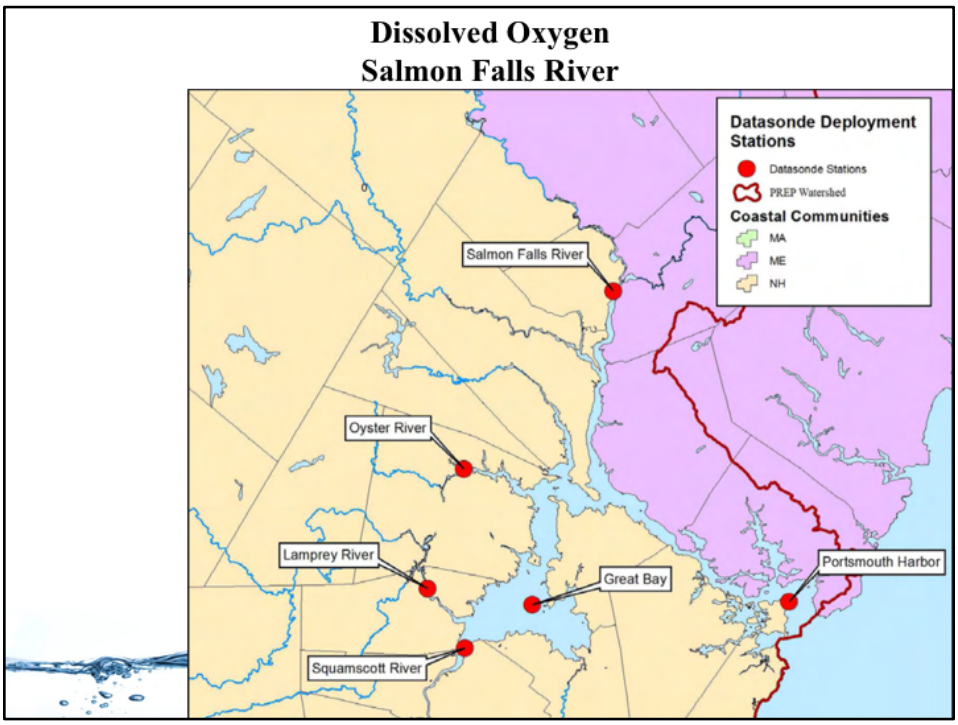

Dissolved Oxygen
Oyster River
Datasonde Deployment Stations
Datasonde Stations
PREP Watershed
Coastal Communities
MA
ME
NH
Salmon Falls River
Oyster River
Lamprey River
Great Bay
Portsmouth Harbor
Squamscott River

Dissolved Oxygen % Saturation
Oyster River



Dissolved Oxygen -- Concentration
Oyster River




Dissolved Oxygen
Salmon Falls River
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PREP Watershed
Coastal Communities
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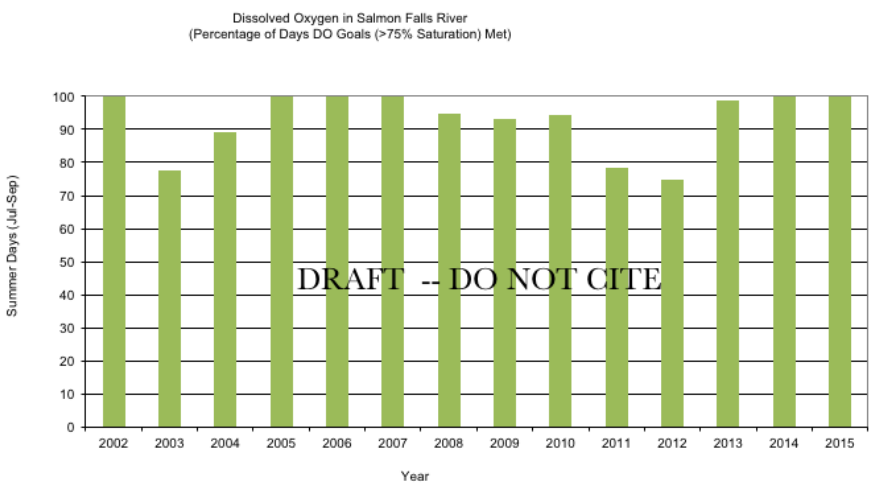
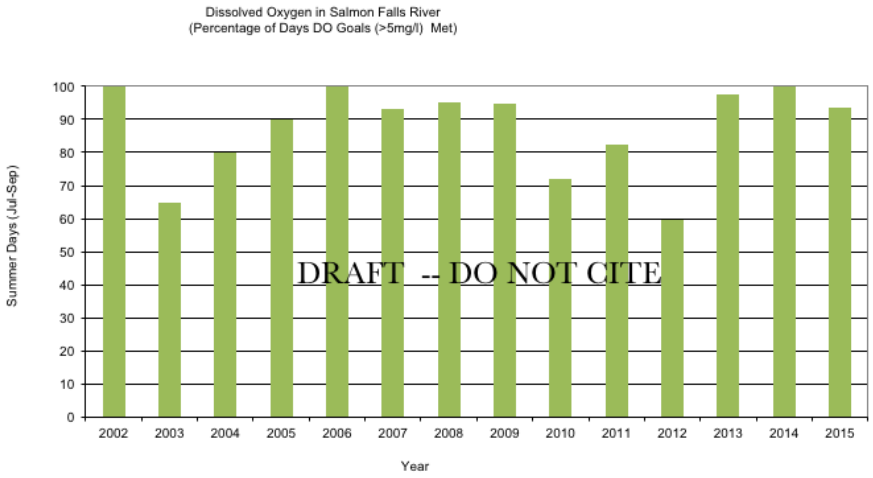
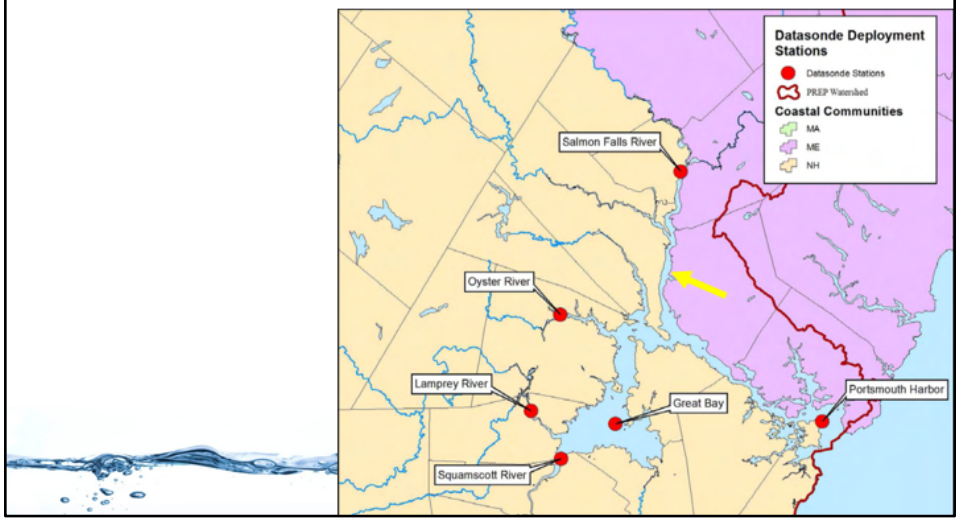
Dissolved Oxygen % Saturation
Salmon Falls River

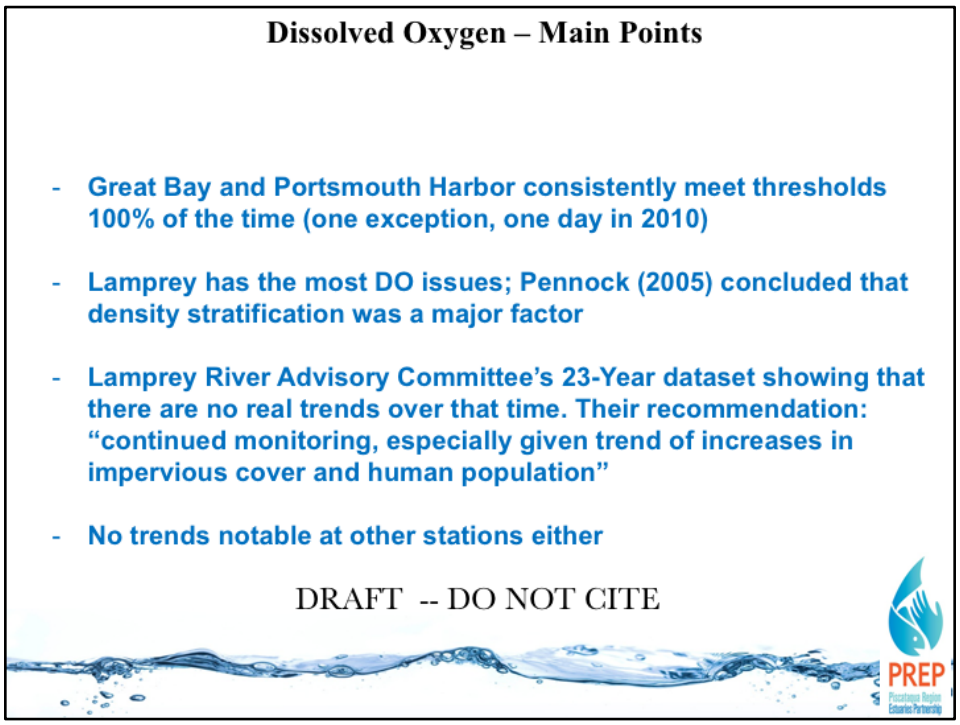


Dissolved Oxygen -- Concentration
Salmon Falls River



Dissolved Oxygen -- Concentration
Cocheco River



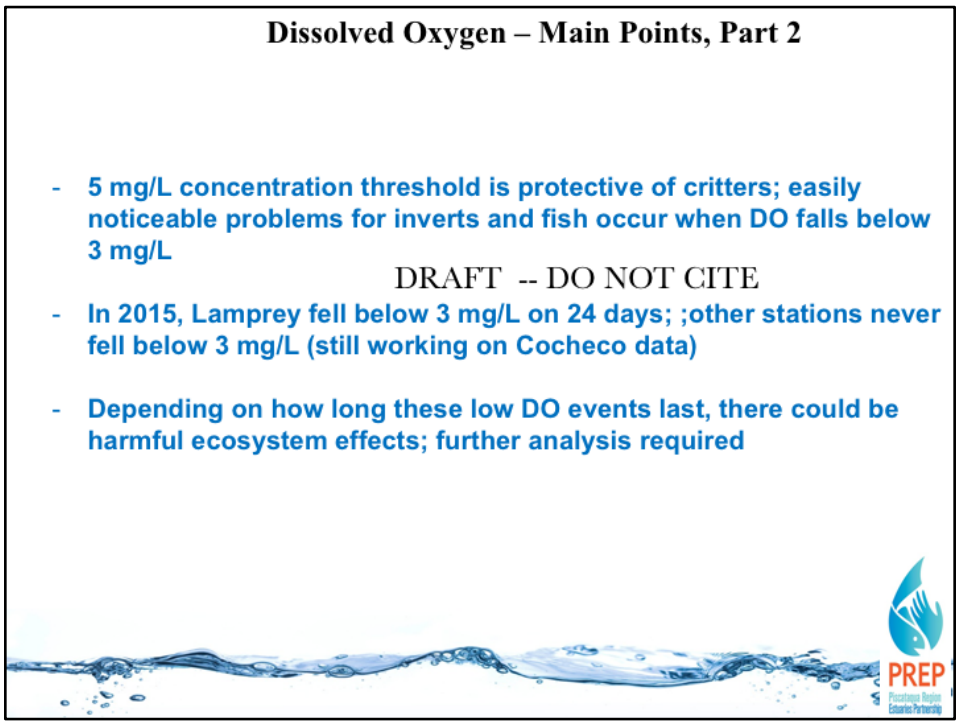


Kalle: Any comments on these points

John Hall: I would just say that the Squamscott river station is not the right place to take the sample. That station is the same as sampling in GB. I would move that station.

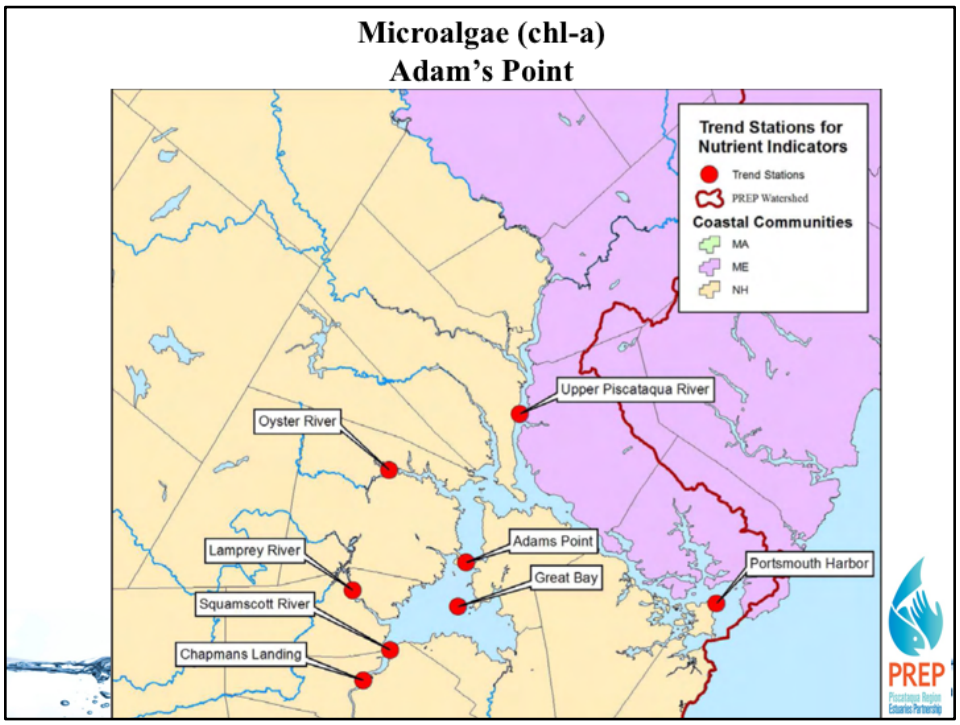
Tom: Comment on Lamprey having the most DO issues. Based on data sets that is true, but we only have one datasonde in the Lamprey and it's not at the mouth of the river, so it's not a true comparison.

Ken Edwardson. As folks said earlier, if you you use box and whisker plots for saturation, you'll see some interesting patterns that you're not seeing right now.



Kalle: Any comments on this?

No comments.


Microalgae (chl-a)
Adam's Point
Trend Stations for Nutrient Indicators
Trend Stations
PREP Watershed
Coastal Communities
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Upper Piscataqua River
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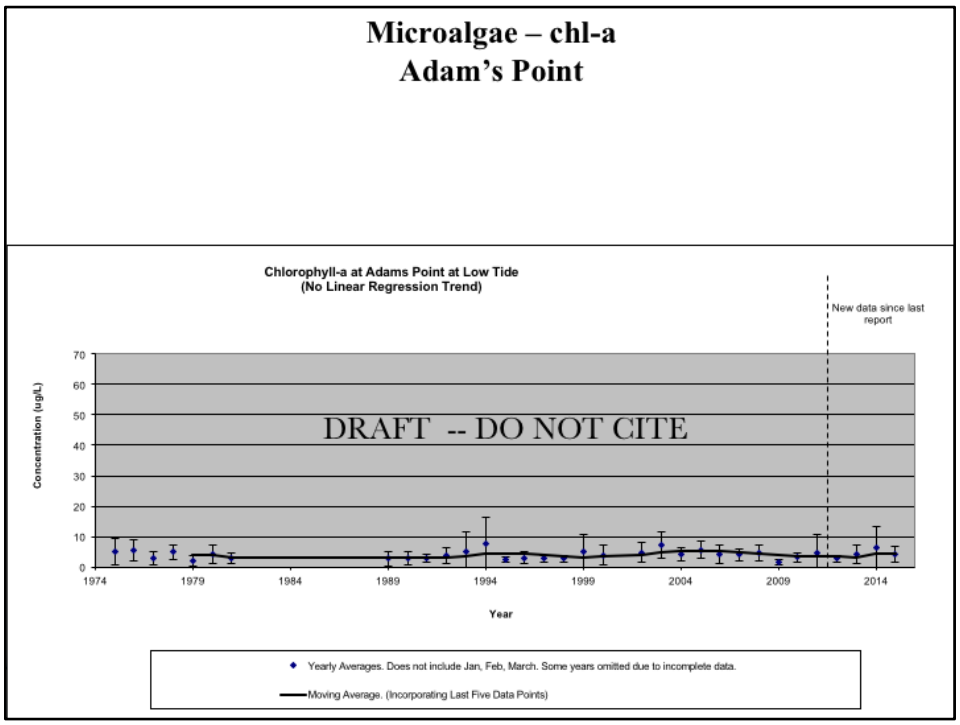
Squamscott River
Chapmans Landing
PREP



Kalle: As we get into these data, I just want to mention that I'm actually showing chlorophyll-a and tss together at each station. The reason for that is because these two parameters are often looked at very carefully with regard to attenuating light relative to eelgrass. And some of the work done in other estuaries suggests certain levels that we should aim for with regard to these levels, such as 15 mg/L for TSS and 15 ug/L for chl-a. But again…those are not benchmarks we can import wholesale and use as our system is very different.

Suspended Sediment Concentrations
Adam's Point

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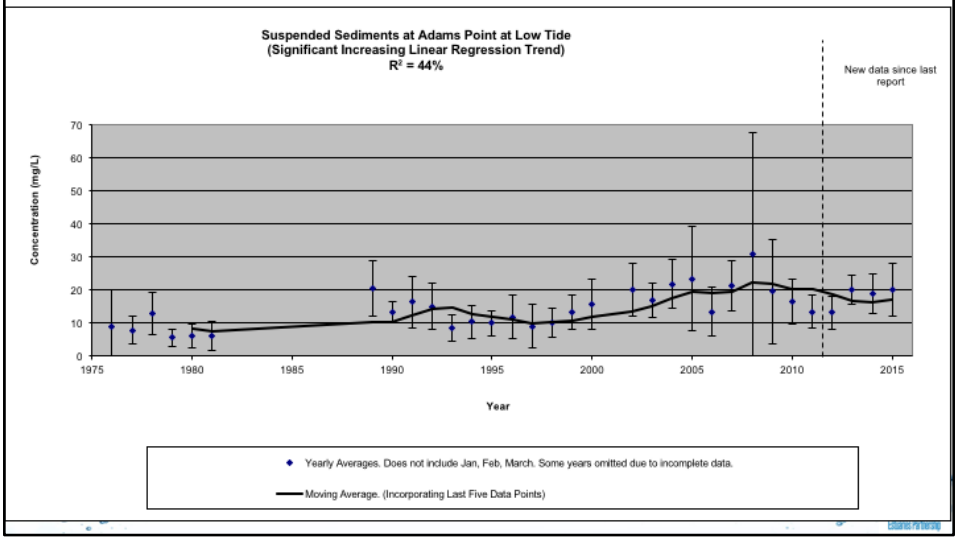
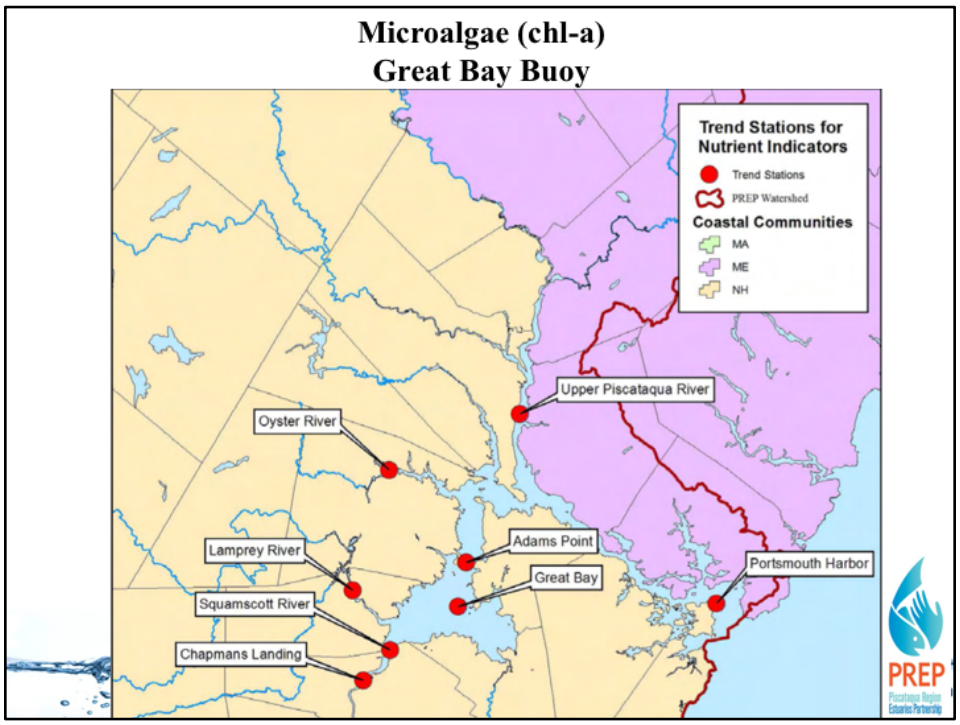


- Talk about the 15 microgram/L threshold


Microalgae (chl-a)
Great Bay Buoy
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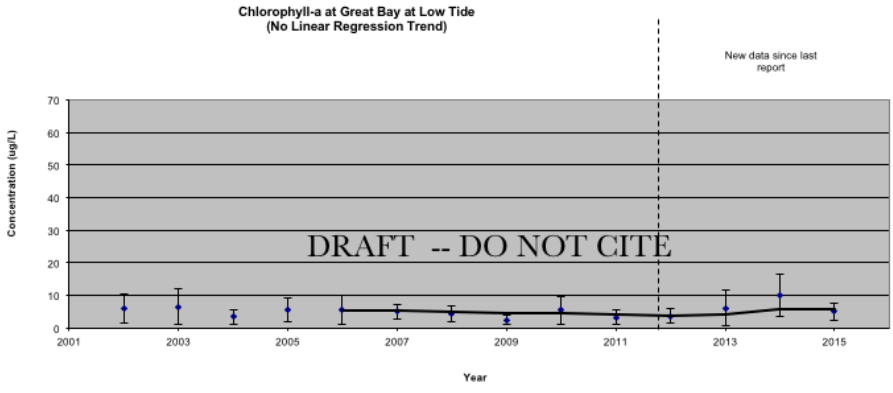
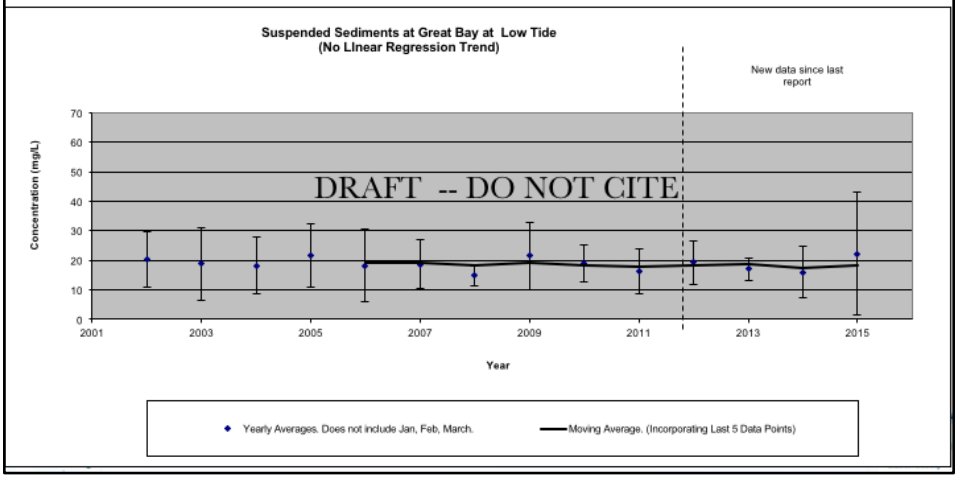
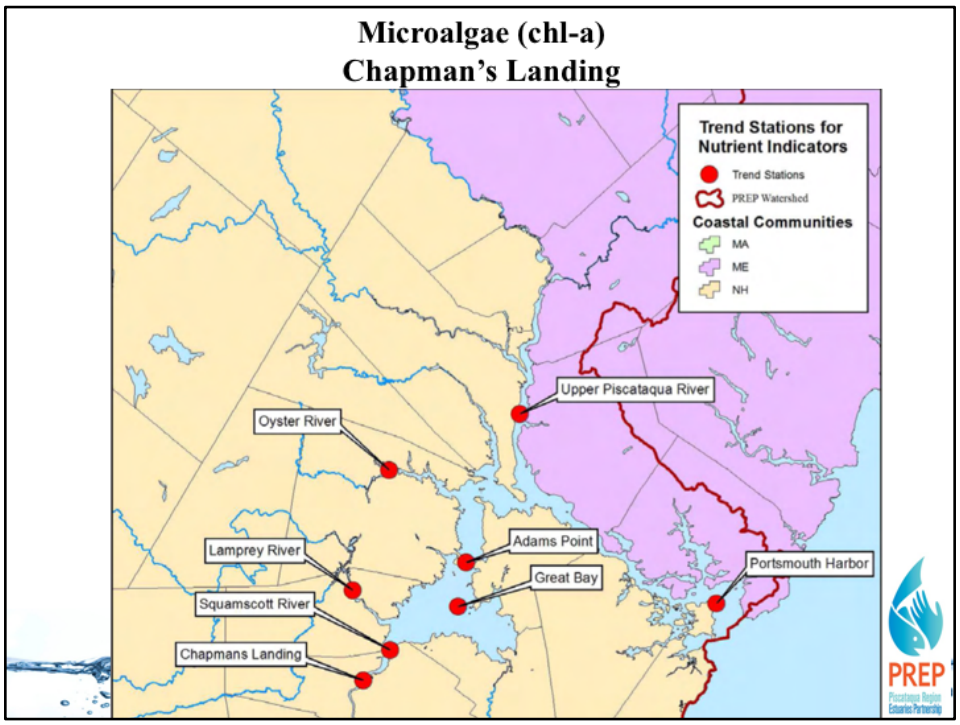
Microalgae – chl-a
Great Bay Buoy



Suspended Sediment Concentrations
Great Bay Buoy




Microalgae (chl-a)
Chapman's Landing
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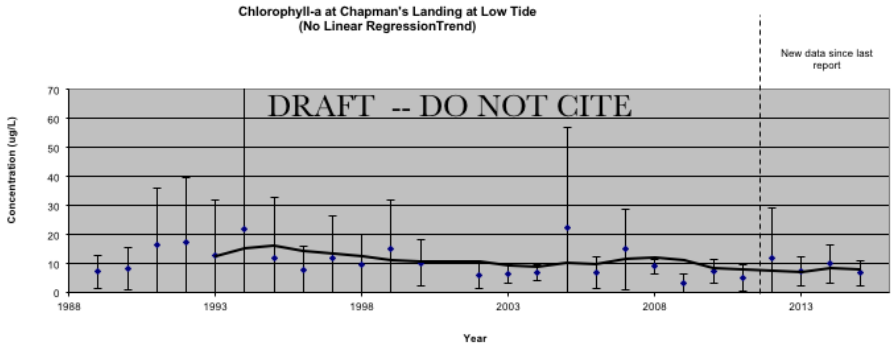
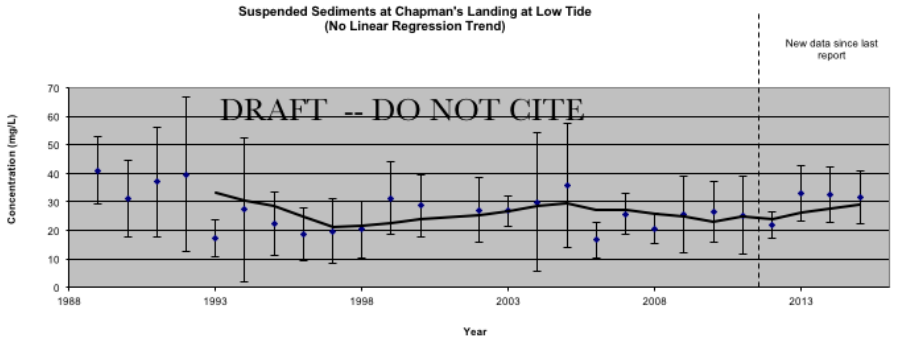
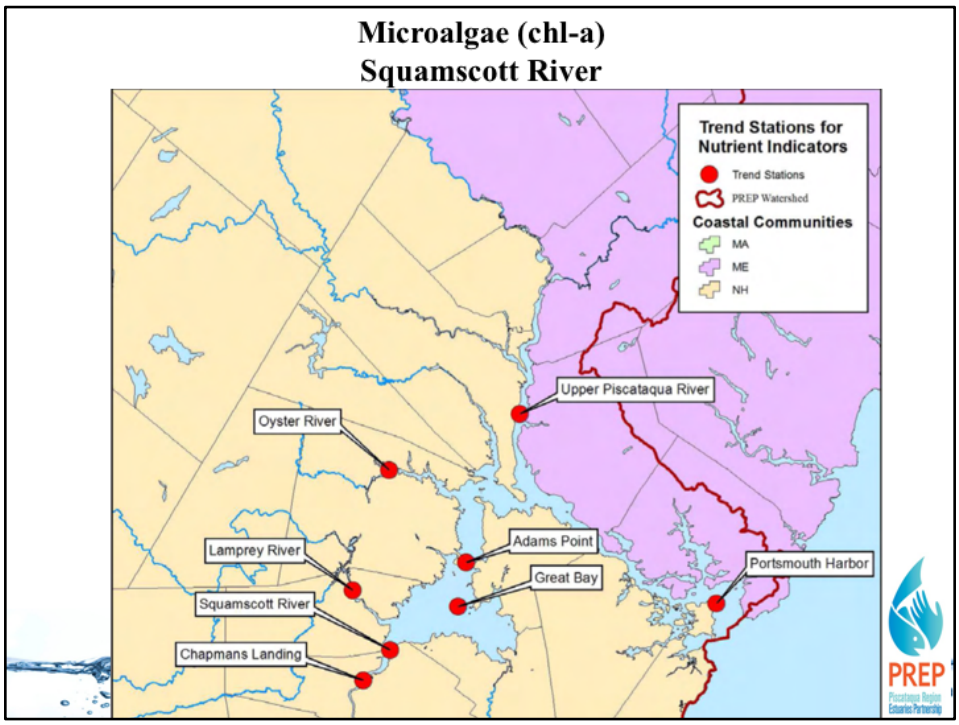
Microalgae – chl-a
Chapman's Landing



Suspended Sediment Concentrations
Chapman's Landing




Microalgae (chl-a)
Squamscott River
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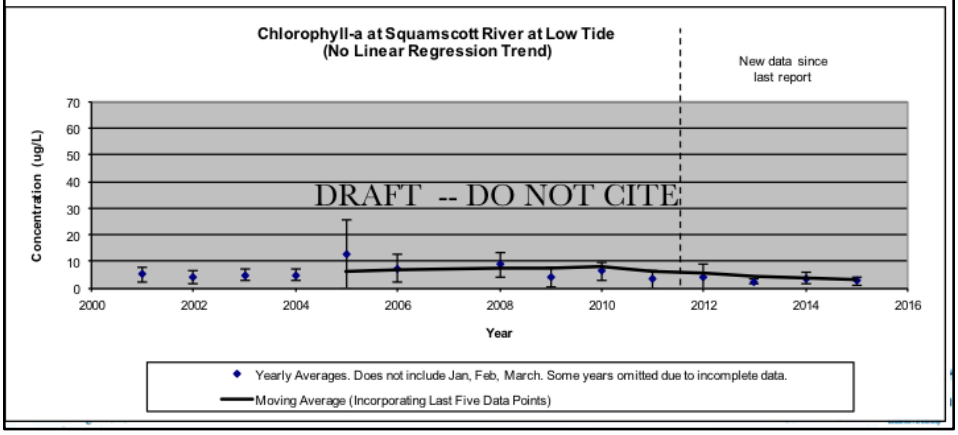
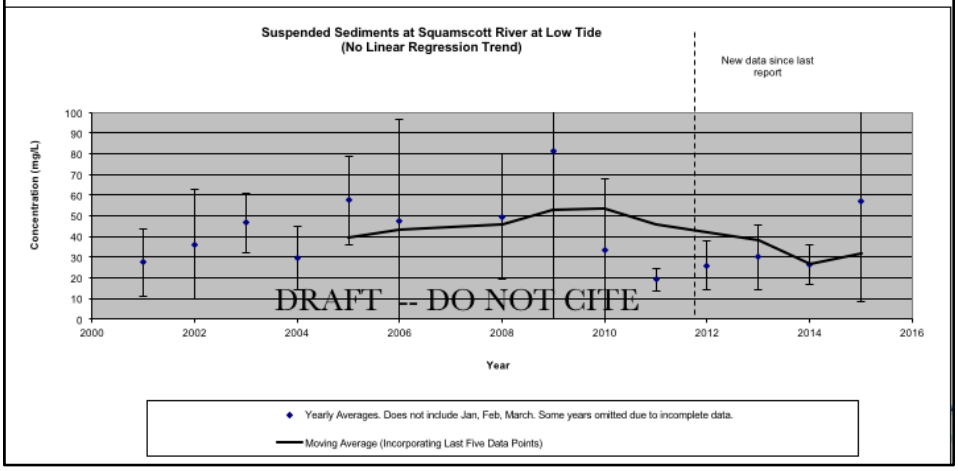
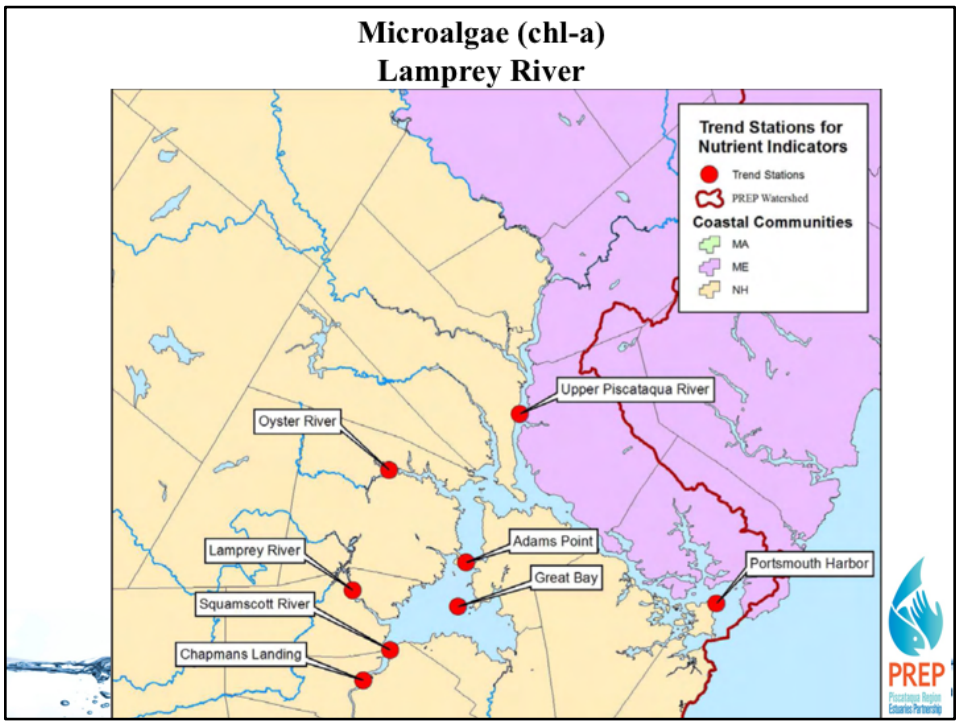
Microalgae – chl-a
Squamscott River



Suspended Sediment Concentrations
Squamscott River

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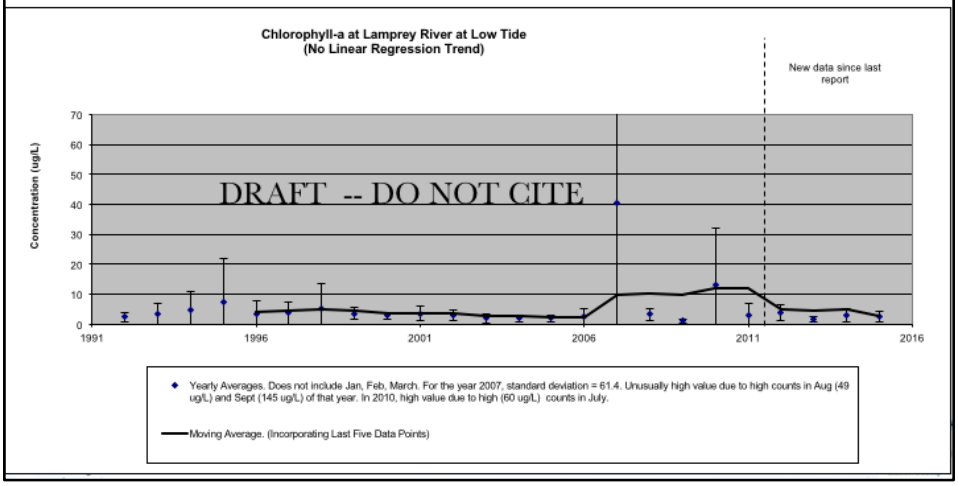
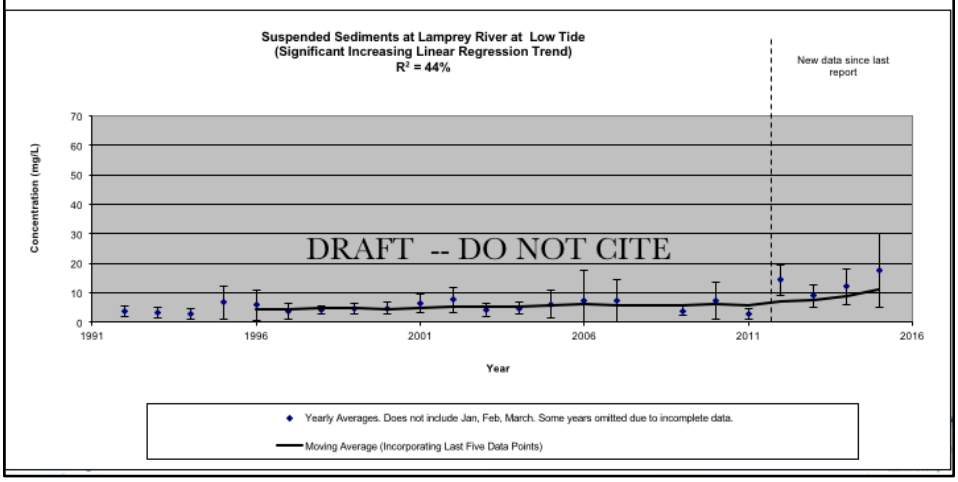
Microalgae – chl-a
Lamprey River



- Looking at DO data, 2002 was the second worst year on record; 2007, conc. Threshold met 48% of the time; 2010, conc threshold met 12% of the time

Suspended Sediment Concentrations
Lamprey River



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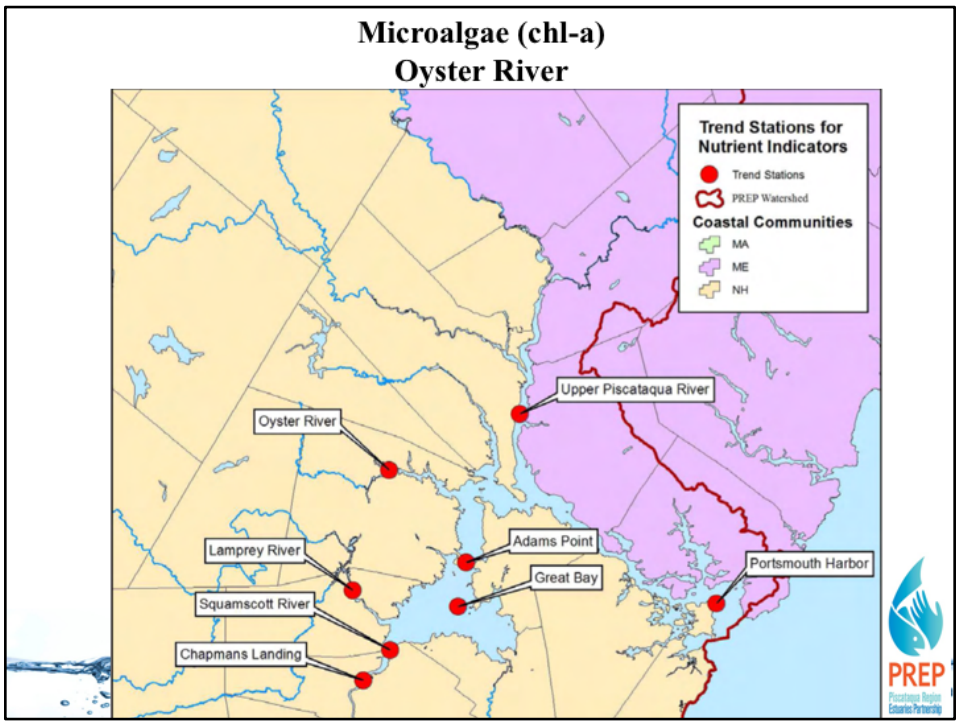
Microalgae (chl-a)
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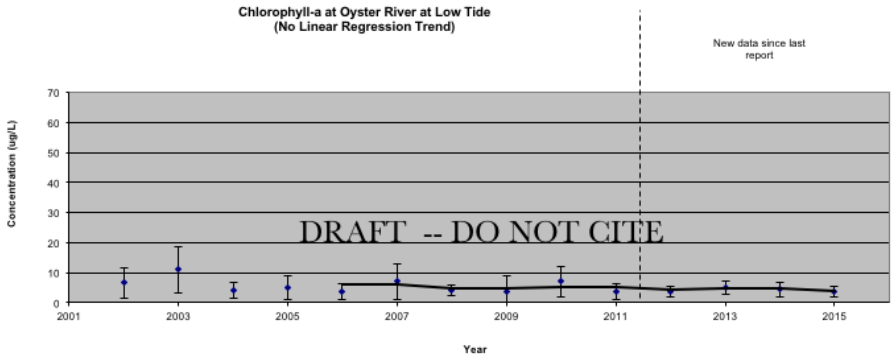
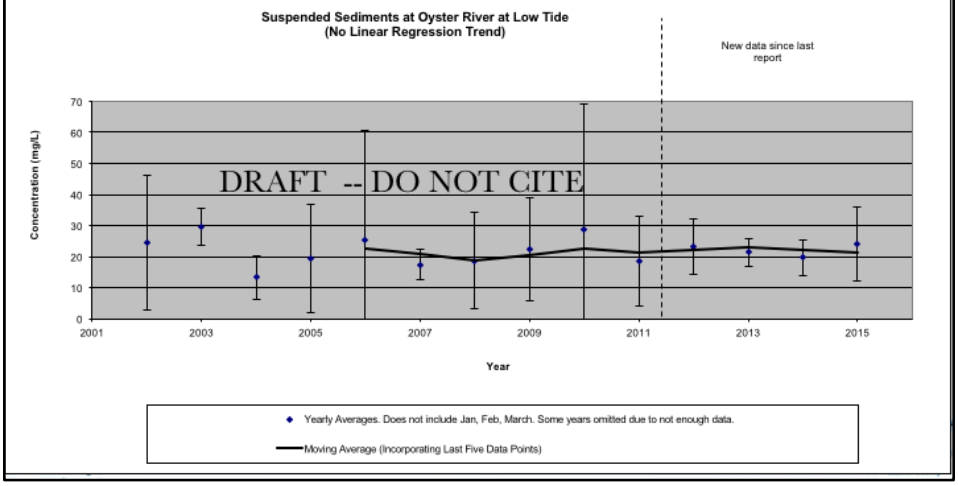
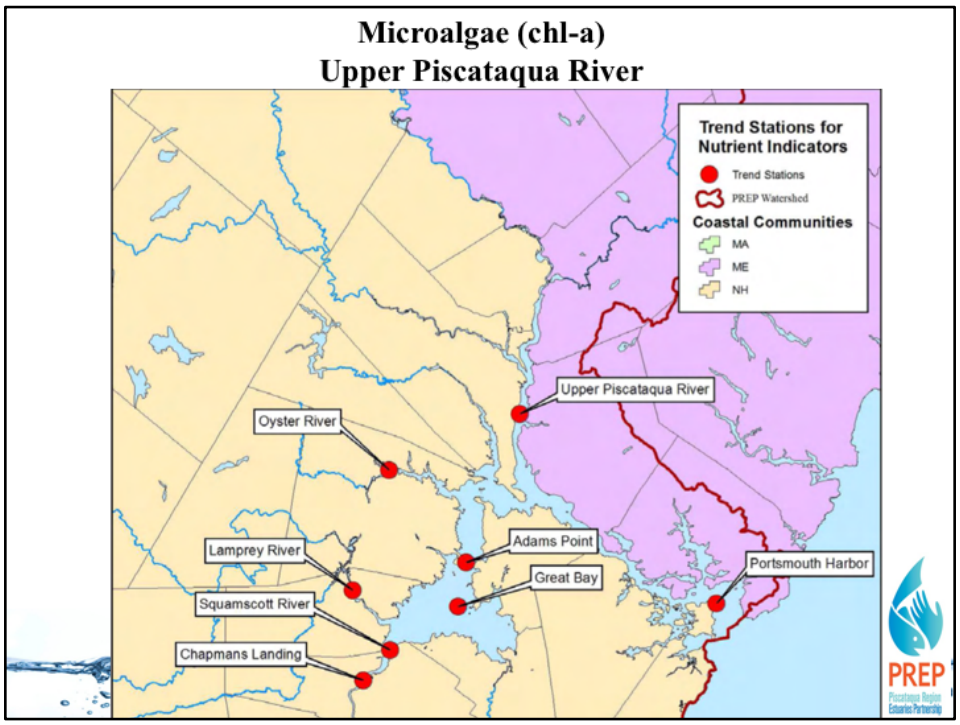
Microalgae – chl-a
Oyster River



Suspended Sediment Concentrations
Oyster River




Microalgae (chl-a)
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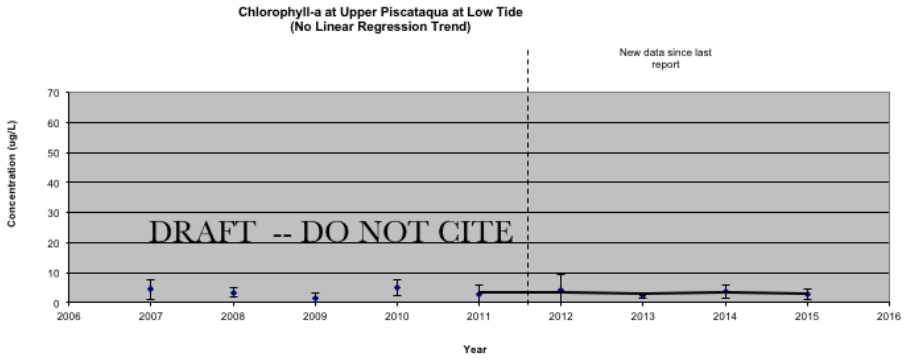
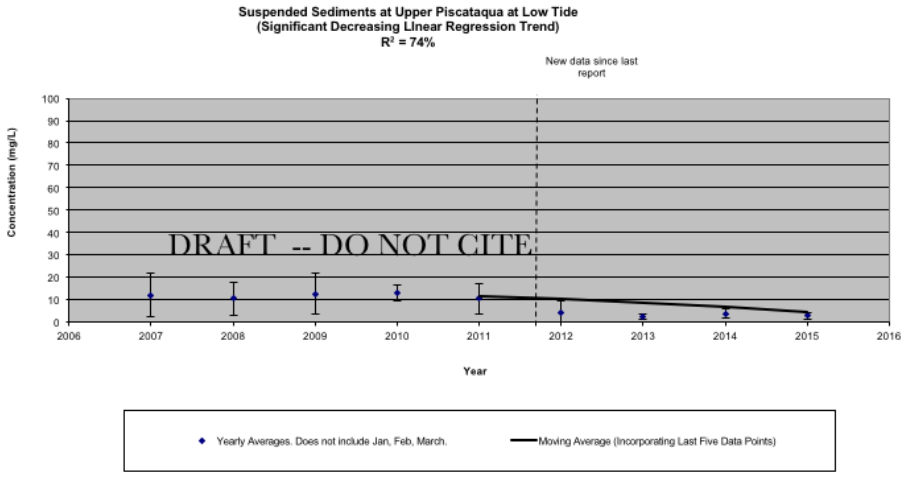
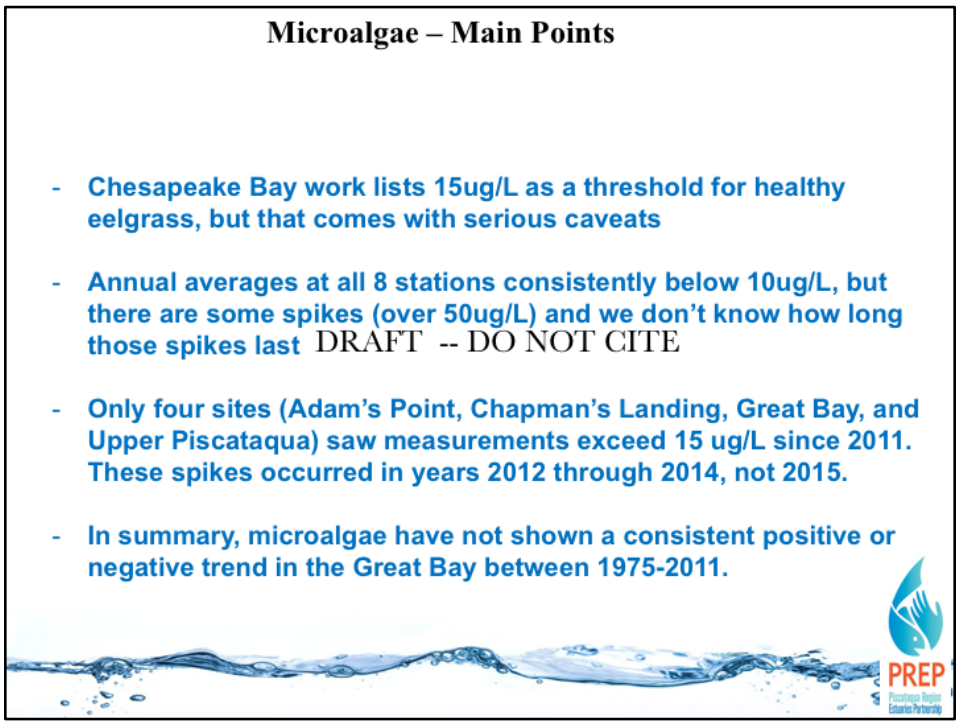
Microalgae – chl-a
Upper Piscataqua River



Suspended Sediment Concentrations
Upper Piscataqua River





Kalle: Any thoughts or comments?

John Hall: Suspended sediments is another parameter where it helps to also see on the same graph the precipitation data.

Paul Stacey: You might consider a scatterplot to look at TSS and chl-a against each other.

Dan A: EPA also deploys sondes to look at chl-a and DO, and we do see periods super saturation where the % saturation never goes under 100%. Is there a way to incorporate the data gap, or whether that super saturation is coming from microalgae?

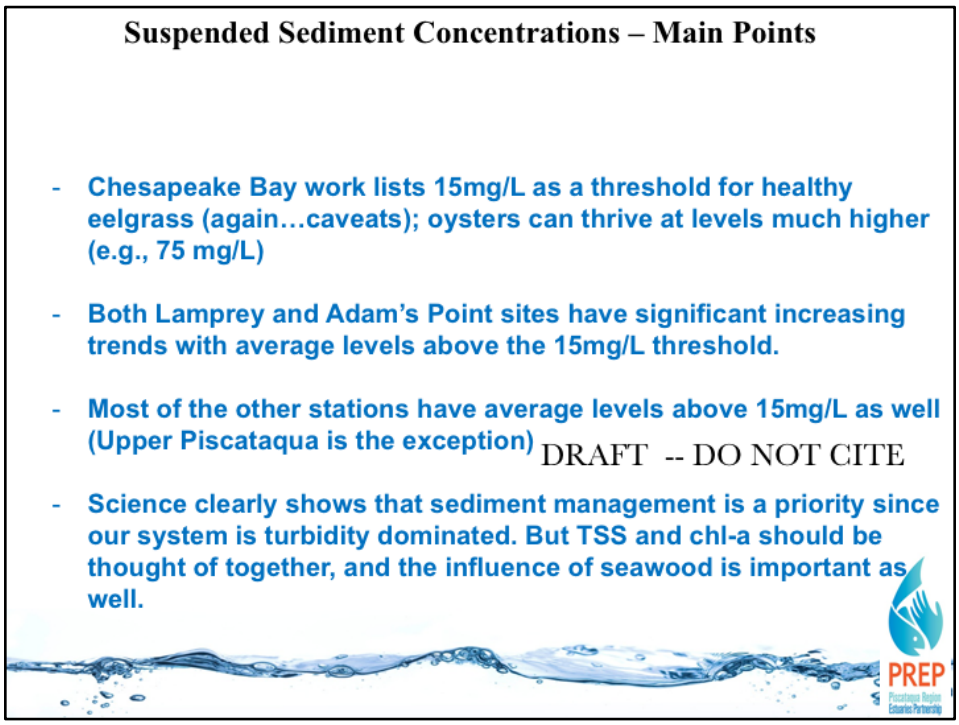
Kalle: I hope…I'm not sure we will have the time to do the data manipulation you mentioned, but it certainly seems worthwhile.

Fred: If you're not including benthic algae, I think that the term "phytoplankton" would be better than microalgae.

John Hall: With these comparisons to other estuaries, just think about whether they were also only using low-tide data, because it skews the comparison. In Chesapeake Bay, for example, I don't think they're using low tide data only.

Erick: Would be nice if you could take these samples at the same time to get a sense of the big picture.

Fred: You can actually do that with satellite-based technologies now.



Kalle: Any thoughts on these points?

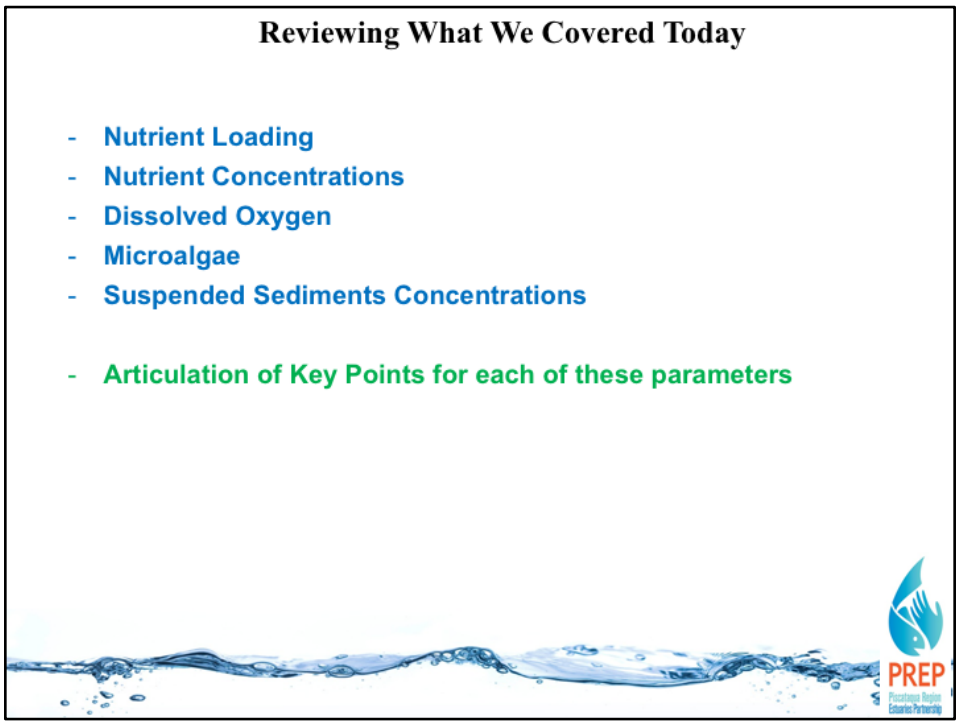
Rob Roseen: Lack of variability in TSS, most of the measurements taken are for things that are largely suspended. TSS looks at course particles that fall out very quickly. Effective TSS is 5 microns or less…it takes weeks to settle out. The big stuff from a storm or unstable commercial development will be out of the water column very quickly, so you have to be aware that you're missing that.

Ted: Before we attribute a lot to precipitation there are a lot of interesting things going on in relation to TSS. For example, land development permits over time. You see in fall of 2008/2007 into 2008 you see it drops from 1,000 permits to 0. Because of the recession. You see this for a period of 5 years (essentially no new development).

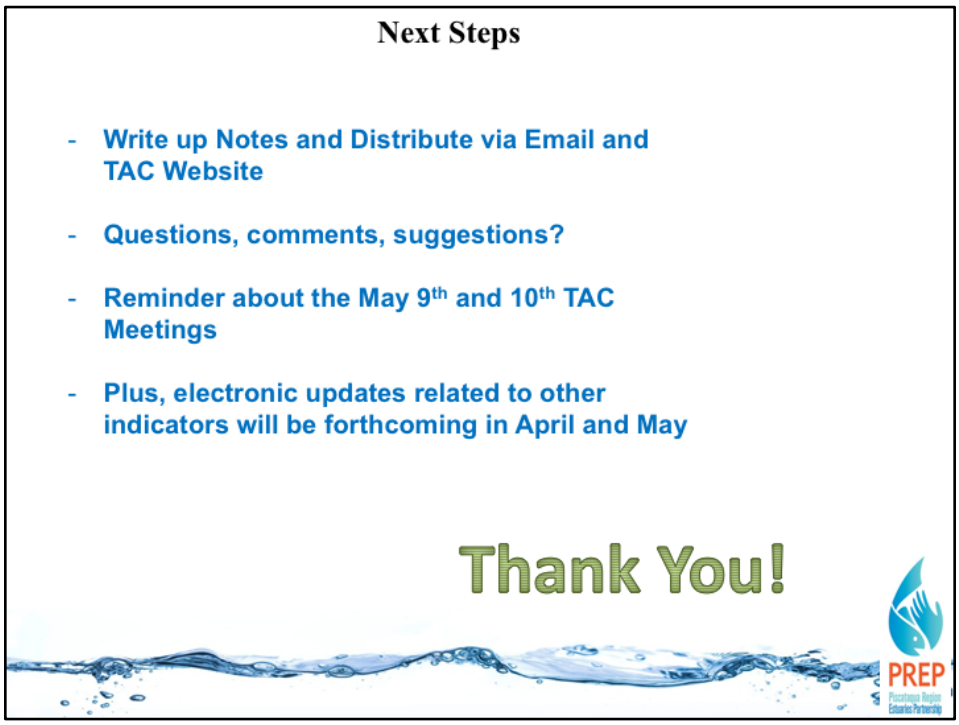
Paul Stacey: Along those lines, Great Bay is sensitive to resuspension from a good rain fall at low tide or wind. Lots of factors that don't start from land uses.

Fred: Also the presence or absence of eelgrass has a big effect on resuspension of sediments.

Rob: Why don't we use turbidity instead of TSS; might be a better measure since it's correlated with smaller particles.



Kalle: Just reviewing what we covered today.



Kalle: Thanks everyone for your time.